HEATING AND VENTILATING

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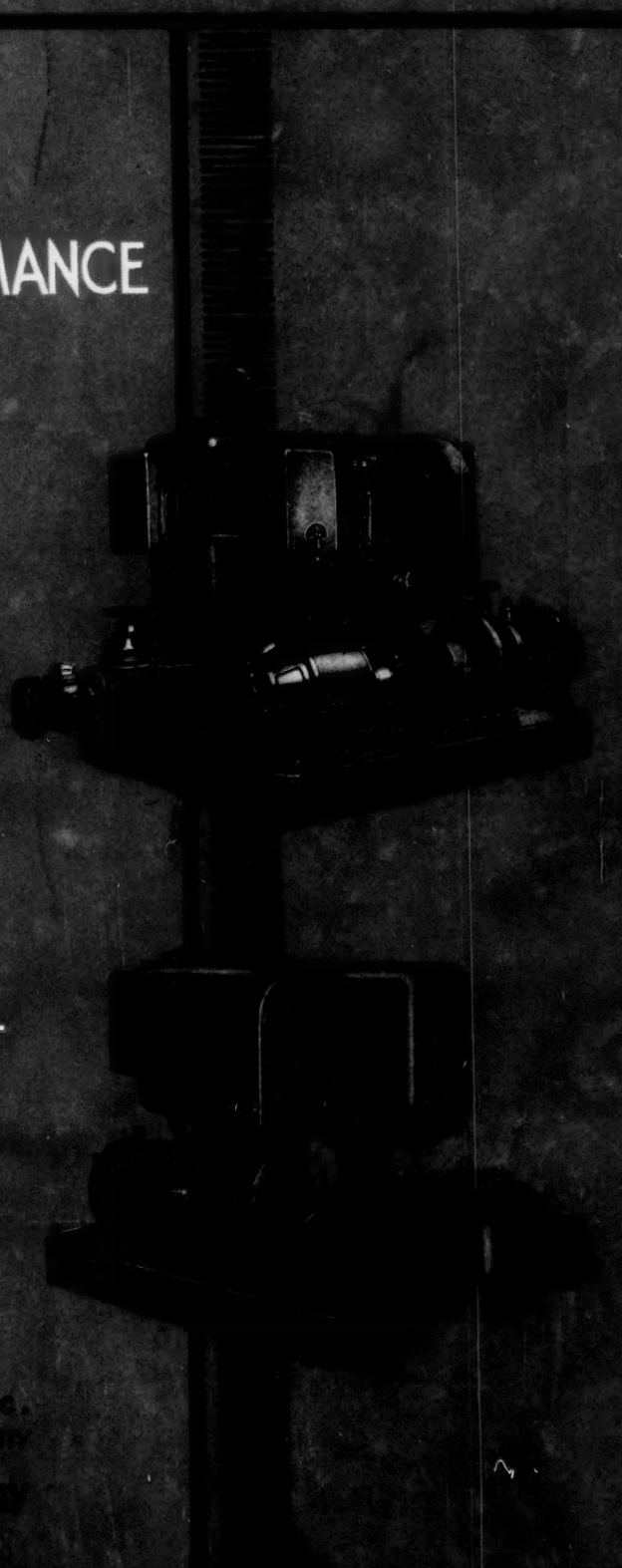
OCTOBER 1930

AMES
THE VACUUM PUMP OF PERFORMANCE

THE PUMP
YOU WILL
EVENTUALLY
BUY

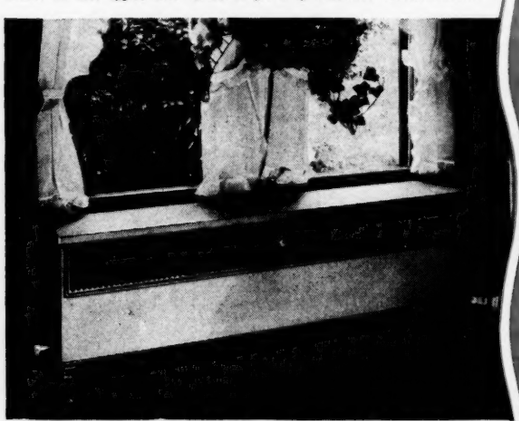
DISTINCTIVELY DIFFERENT



AMES PUMP COMPANY, Inc.
CHURCH STREET NEW YORK CITY
Affiliated with
AMERICAN LOCOMOTIVE COMPANY

Today's Heating Problem *Demands* SEAMLESS COPPER Radiation

The concealed type McQuay Radiator fits snugly flush with the wall under bookcases, windows, etc., with only two grilles visible—one inlet for cold air and one outlet for heated air. The heated air radiates parallel to the floor, heating the floors first and circulating in every direction. The flow of warm air can be controlled by a shutter arrangement over the outlet. Built in all types and sizes to fit any interior construction.



The cabinet type McQuay Radiator is housed in an artistic cabinet built of sturdy, rustless copper alloy steel. One may sit on the unit without bending it. The heating unit of all McQuay Radiators of seamless copper tube and fin construction is the most efficient medium for conducting heat ever designed. It gives the heat sufficient initial velocity to drive it into every corner of the room and lowers fuel costs by driving into circulation every bit of heat generated.

Heat That Cold Spot

In garages, factories, warehouses—wherever an area remains unheated by the central system—a McQuay Unit Heater provides warm air in constant circulation. Heated air is forced *down* into the working area where it is most needed. Fuel is saved because *all* the heat is used . . . There's a McQuay Unit Heater for every heating need. Initial cost is usually less than for pipe coils or cast-iron radiators.

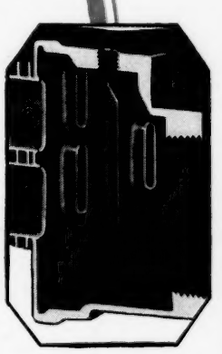
Architects, heating engineers and contractors consistently urge seamless copper radiation in new buildings. They specify it for longevity of the installation . . . because non-corrosive copper eliminates all upkeep cost . . . and because it heats in one-fifth the time of cast-iron radiation. McQuay Cabinet and Concealed Radiators of seamless copper may be installed in any type of building equipped with a central heating system . . . homes, apartment buildings, hotels, hospitals, and office buildings. Ask for specification data.

McQUAY

Cabinet and Concealed

RADIATORS

McQuay Concealed Type Radiators are built into the wall, out of sight, out of the way. They occupy no floor space by fitting snugly into walls, partitions, under windows, book cases, etc. . . . McQuay Cabinet Type Radiators combine unobtrusiveness with smartness. . . . Both types circulate warm air throughout the interior, with the amount of heat subject to control. Both conserve fuel by heating quicker and placing all heat generated where most needed. Both are adaptable to any interior . . . add to its decorative appearance . . . and function as long as the building remains, without maintenance.



The sturdy, totally-welded construction of the all-copper McQuay heating element, which is factory-tested with 300 lbs. hydrostatic and 125 lbs. steam pressure

A complete set of McQuay Catalogs in a suitable binder is available for your files and sent at your request

McQUAY RADIATOR CORPORATION

General Offices: 1600 BROADWAY, N. E., MINNEAPOLIS, MINN.

KEWANEE STEEL BOILERS

Kewanee Boilers are built to "Carry big loads"—even heavy "overloads." For their riveted steel construction is strong enough to withstand the worst punishment a heating boiler can get.

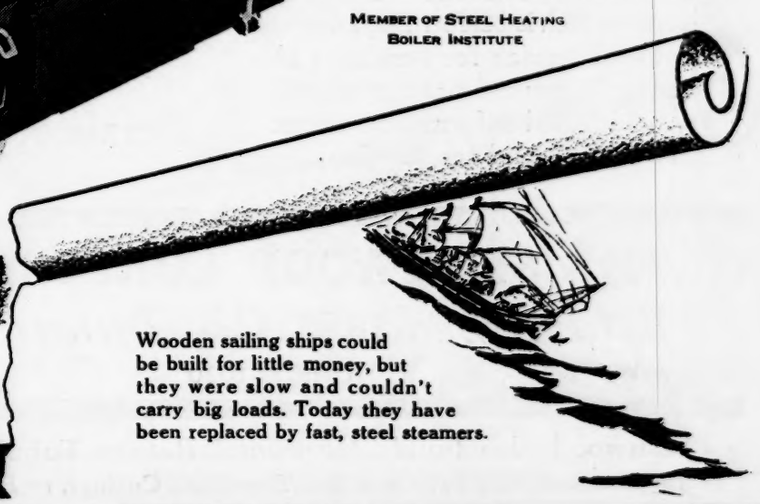
Countless Kewanee Boilers—*installed 40 years ago*—are still on the job, providing dependable heat.

And as a boiler's life is lengthened, its *actual cost is reduced*—making it a truly economical purchase.

KEWANEE BOILER CORPORATION
division of American Radiator & Standard Sanitary Corporation
KEWANEE, ILLINOIS
Branches in Principal Cities

MEMBER OF STEEL HEATING BOILER INSTITUTE

It costs less to OWN a KEWANEE



Wooden sailing ships could be built for little money, but they were slow and couldn't carry big loads. Today they have been replaced by fast, steel steamers.

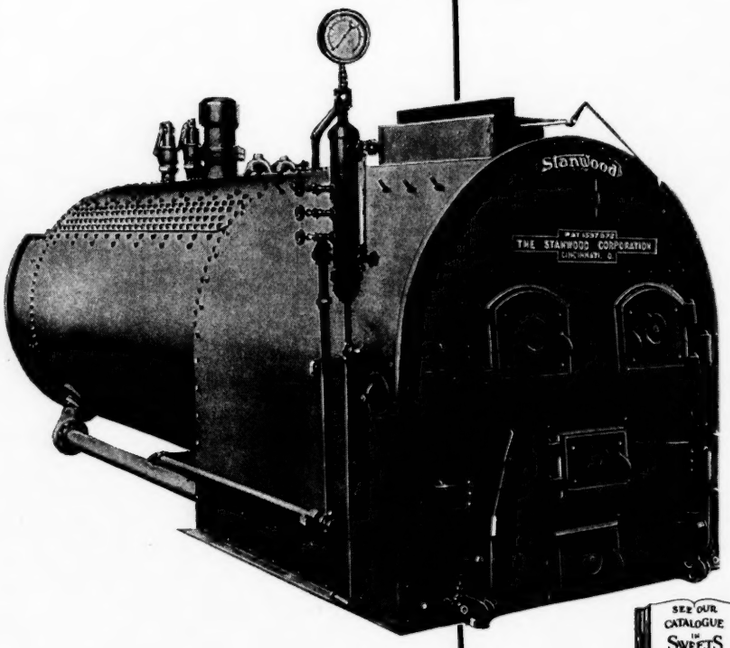
HEATING AND VENTILATING, *formerly* THE HEATING AND VENTILATING MAGAZINE, published by BUILDING DIVISION of NATIONAL TRADE JOURNALS, INC., 521 Fifth Ave., New York, N. Y. Subscription rates: United States, $2.00; Canada, $2.50; Foreign, $3.00. Single Copies, 30 cents. Vol. XXVII, No. 10, October, 1030. Entered as second-class matter, April. 18, 1925, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Copyright 1930, by NATIONAL TRADE JOURNALS, INC.

Stanwood Boilers

In PRINCIPLE, DESIGN, AND PERFORMANCE *are Hard to Equal*

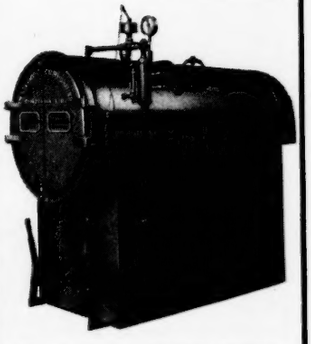
When it comes to measuring one boiler against another — let installation conditions and type of service be your guide.

In the first deciding factor, Stanwood stands alone in the field—because the extremely low water line and headroom requirements (lowest on the market) permit installation in the shallowest of basements. The second, that of service, still remains unquestioned — only good and enthusiastic reports are received from owners. The rapid water circulation extracts every possible heat unit, thereby increasing efficiency and creating actual fuel economy. Practical knowledge of boiler principles and designs is responsible for the Stanwood self-contained Portable Boiler which is performing an economical service for hundreds of users. If you are not acquainted with detailed information about this boiler, send for the facts.



SEE OUR CATALOGUE IN SWEETS

There's a STANWOOD for every installation— Whether it's Small or Large



The Stanwood STEEL WELDED HEATING BOILER is furnished in Smokeless or Direct Draft types, mechanical firing for oil, coal, or gas—Compact, requires minimum installation space — all seams and joints electrically welded into one solid leak-proof unit—for 15 lbs. pressure.

THE STANWOOD CORPORATION
Established 1891 *Cincinnati, Ohio*
Dept. D-1030

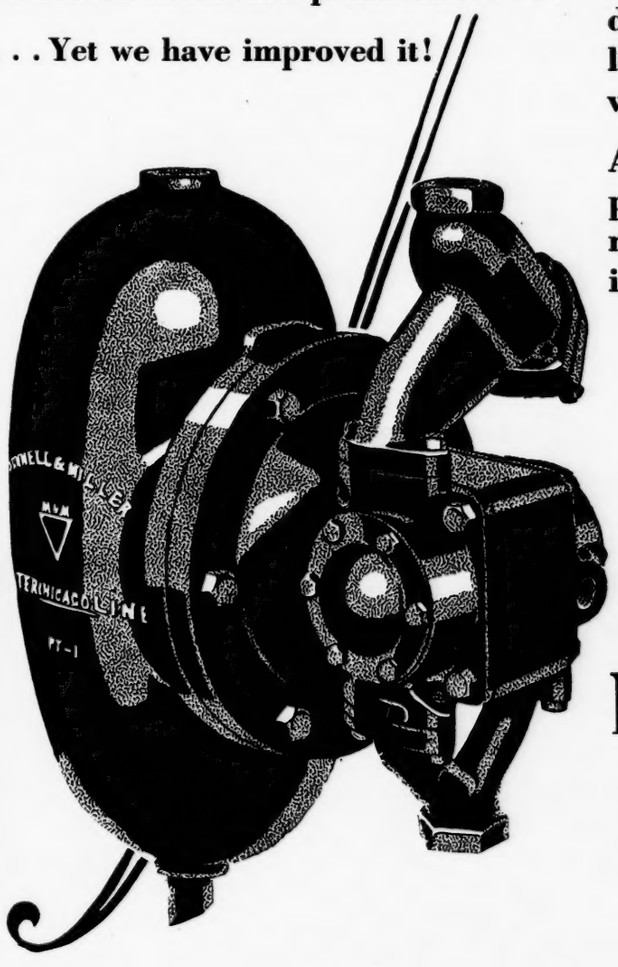
Stanwood also builds Horizontal Return Tubular Boilers
for Catenary Bag Type and Box Type Steel Casings, or Brick Settings

...yet we have *improved* it!

When we say that the McDonnell No. 28 Self-Cleaning Rotary Valve Duplex Feeder is the finest and most dependable boiler feeder ever built, we believe that we merely repeat the story that the feeder itself has written into the performance records of America's boiler room.

To all intents and purposes the No. 28 Feeder could have maintained its leadership and kept right on adding to its record of flawless performance . . .

. . . Yet we have improved it!



We have reached out for the most modern advances in metallurgy—have replaced the excellent Monel and bronze valves with still better stainless steel valves of exactly the same quality that is used in finest surgical instruments. We have also added ingeniously designed improvements and refinements wherever possible.

You who have specified this feeder with so much confidence in the past, can specify it with even greater confidence now. There is only *one* self-cleaning Duplex feeder with dependable rotary valves, adjustable water levels and adjustable differential between valve openings. It is the McDonnell No. 28.*

Ask for facts about this feeder and the complete line of feeders, also for a copy of our new Service Recommendation Chart which is just off the press.

**The McDonnell No. 29 Self-Cleaning Single Valve Feeder is identical in construction with the No. 28—the only difference is that there is no overflow valve on the No. 29.*

McDONNELL & MILLER
1314 Wrigley Bldg., Chicago
Eastern Office: Grand Central Terminal, New York, N. Y.

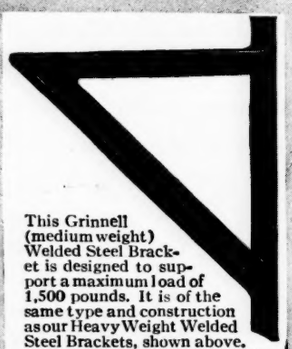
The Improved
McDONNELL
SELF-CLEANING DUPLEX
Feeder

"Doing one thing well"—and ever better

THERE IS A GRINNELL FOR EVERY

Grinnell (heavy weight) Welded Steel Brackets are designed to support a load of 3,000 pounds, yet are light in weight as compared with the usual cast iron bracket.

The Adjustable Pipe Stand shown with the Bracket is adjustable as to height by simply adjusting bolts on the roll stand. Lateral adjustment or movement is also possible with this Adjustable Pipe Stand by sliding the stand on the Welded Steel Bracket.



This Grinnell (medium weight) Welded Steel Bracket is designed to support a maximum load of 1,500 pounds. It is of the same type and construction as our Heavy Weight Welded Steel Brackets, shown above. It may be used with our Adjustable Pipe Stands, Anchor Chairs, Pipe Seats, etc., in the same way as our Heavy Brackets.

NEITHER the steamfitter nor the local blacksmith has the proper equipment to produce hangers economically.

Large contractors will not stand for the expense of brackets and hangers made on the job. Nor will they take chances on their unknown strength. That is why so many specify Grinnell hangers. They know that there is a size and model in the *complete* Grinnell hanger line for every construction need.

Grinnell swivel hangers are self-locking and they stay locked at the level where they are set. To level a line takes only a few seconds.

Grinnell Universal I-Beam Clamp Hangers of forged steel are being specified by engineers for suspended floors, ceilings, conduits, etc., as well as for pipe lines.

Write for the Data Book

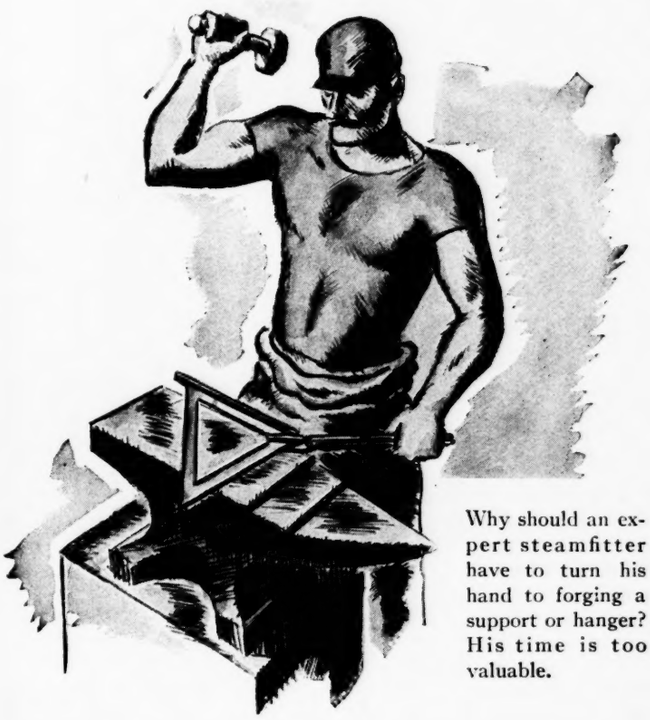
You will find the Grinnell Pipe Hanger Catalogue No. 5 and Engineering Data on Pipe Fabrication

This Grinnell (light weight) Welded Steel Bracket is designed to support pipe lines up to and including 6-in. All sizes of this light bracket are designed for a maximum load of 750 pounds.

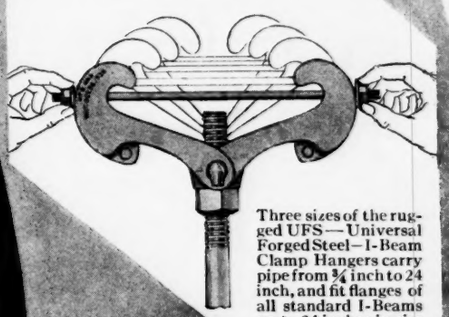
Bracket ends are drilled to take hanger rods up to and including ¾ in. in diameter.

Pipe 3 ½-in. and smaller may be hung from any other point on the horizontal member by using the Grinnell Steel Bracket Clip, shown at midpoint on the horizontal member.

GRINNELL HANGER FOR CONSTRUCTION NEED



Why should an expert steamfitter have to turn his hand to forging a support or hanger? His time is too valuable.



Three sizes of the rugged UFS—Universal Forged Steel—I-Beam Clamp Hangers carry pipe from ¾ inch to 24 inch, and fit flanges of all standard I-Beams up to 24 inches in size—truly adaptable to every conceivable condition in pipe line support.

Book valuable for their ready reference tables covering pipe hangers and supports, fabrication data, etc. and the Grinnell Universal Forged Steel I-Beam Clamps. Write for your copy of either one or both. Address Grinnell Company, 265 West Exchange Street, Providence, R. I.

Grinnell Adjustable Swivel Hangers lock themselves at the level where they are set. They are self-locking and they stay locked.

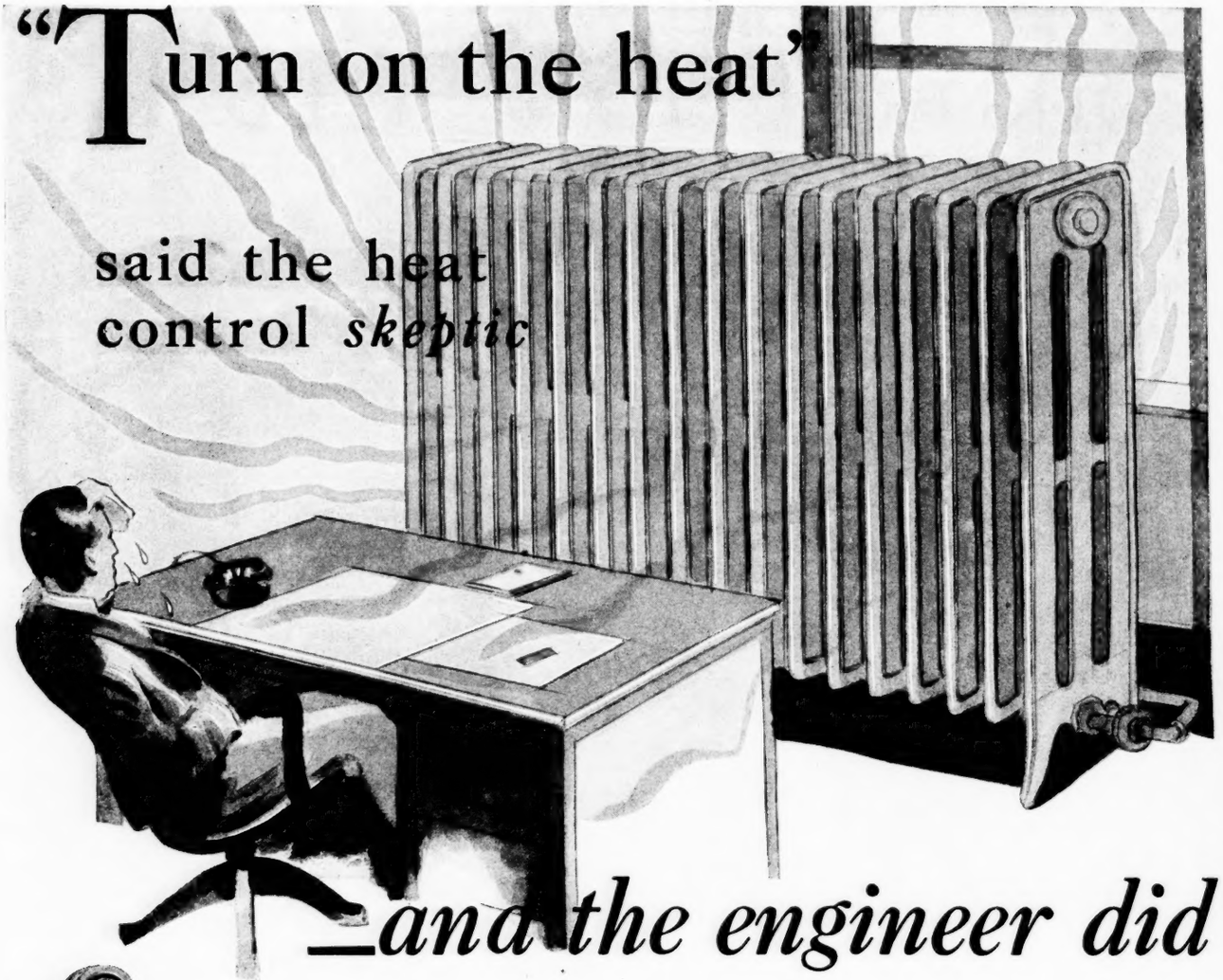
GRINNELL COMPANY

Executive Office: Providence, R. I.

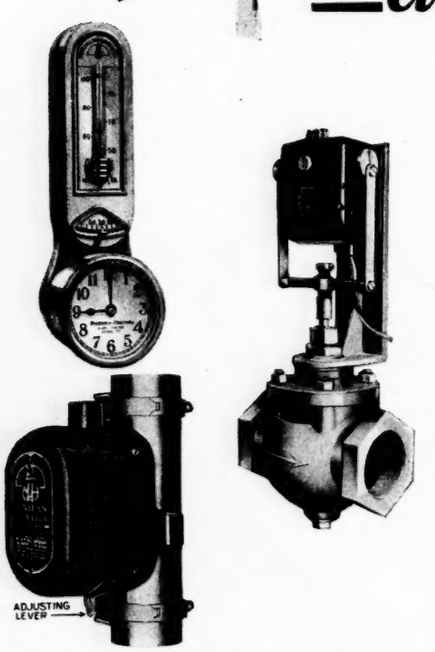
Branches in all Principal Cities

"Turn on the heat"

said the heat control *skeptic*



—*and the engineer did*



This is not the picture of an "Alice in Wonderland" radiator, suddenly grown to monstrous proportions, but the way it seems when a January-sized heating plant starts into action on chill fall days.

For the typical heating system *must* be designed for the most severe weather and *cannot help* but overheat, most of the time, unless subjected to perfect heat control as provided by a Minneapolis-Honeywell system.

Minneapolis-Honeywell systems not only regulate gas, oil and coal fired boilers but provide "tailor-made" heat control for the entire building. Thus you can have 72 degrees in the offices, 65 in the shops, 50 in the warehouse, or any other temperatures needed for maximum personnel efficiency and minimum fuel consumption.

Applicable to radiators, unit heaters or combination systems. Free illustrated catalog gladly sent on receipt of the coupon.

MINNEAPOLIS-HONEYWELL REGULATOR CO.—2715 Fourth Ave. South, Minneapolis, Minn.
In Canada: Minneapolis-Honeywell Regulator Co., Ltd., Toronto.
Branch Offices: New York, Philadelphia, Boston, Providence, Detroit, Cleveland, Chicago, St. Louis, Milwaukee, San Francisco, Syracuse, Rochester. *Distributors* in all principal cities.

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY
2715 Fourth Ave. So., Minneapolis, Minn.

☐ Send me pamphlet on Unit Heater and Sectional Control Systems.
☐ Have representative call. I understand there is no obligation.

Name..... *Position*.....
Company.....
Address.....
City..... *State*.....

MINNEAPOLIS
INDUSTRIAL REGULATORS
HONEYWELL

HOLD YOUR HAND ON THE SMOKE STACK

.....*High stack temperature means wasted heat....*

If a smoke stack is running a temperature, the boiler is not efficient. Heat is being lost up the chimney. In coal-fired boilers... or with oil burners installed in ordinary boilers built for coal firing... stack temperatures are often high. That means wasted heat and high heating costs.

The ordinary boiler... with its short wide flues... is not built to absorb the intense heat of burning oil. It has remained for Gar Wood and his engineers to stop this waste.

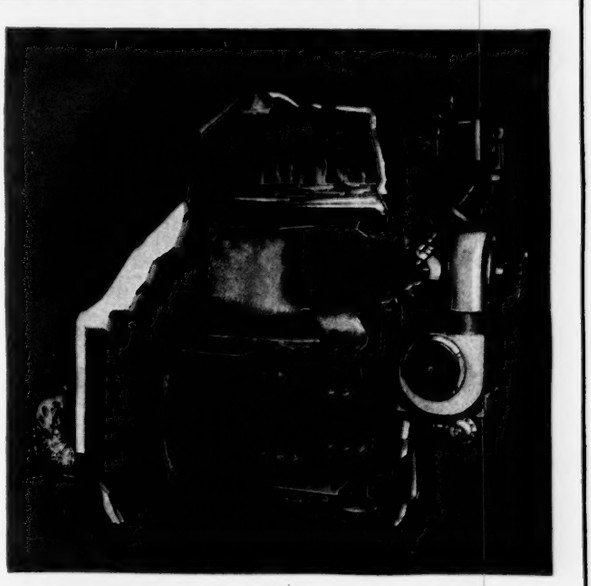
They did it... successfully... by building a boiler like an automobile radiator. Long narrow flue passages *vastly increased the heating surfaces.* Water tubes were baffled to cause a *scrubbing action* of the gases against their walls. The result is an almost complete transfer of heat to the boiler water. Stack temperatures are just high enough to prevent condensation.

The Gar-Wood burner is engineered to fit the boiler's combustion chamber. Almost perfect combustion is effected. From the moment the Gar-Wood burner starts, its flame burns in suspension, without the use of refractory linings.

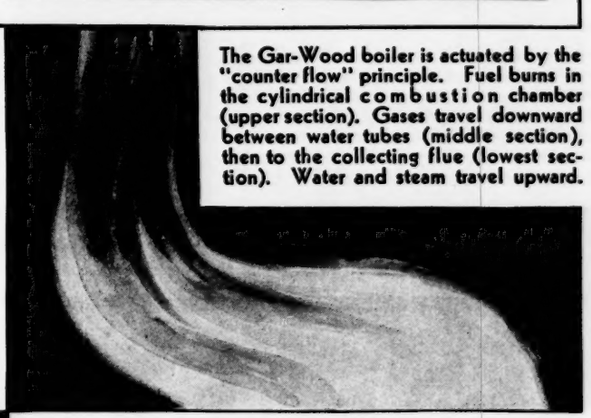
In the ordinary oil burner, the fire pot of the boiler must have a refractory lining. This is a clay tile which will heat quickly and vaporize the oil particles not atomized at the burner nozzle, and thus prepare them for combustion. Until this refractory lining is hot... which takes from three to ten minutes... the burner cannot operate at maximum efficiency.

The Gar-Wood... with boiler and burner engineered into one complete balanced heating unit provides automatic heat from either oil or gas at a cost that is less than coal. Get the facts and figures. *Mail the coupon now.*

Responsible organizations now distributing through the heating trade should investigate the Gar-Wood franchise. Write the factory for details.

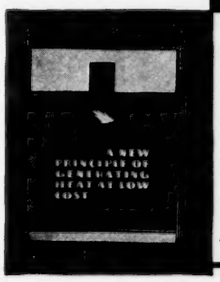


The Gar-Wood boiler is actuated by the "counter flow" principle. Fuel burns in the cylindrical combustion chamber (upper section). Gases travel downward between water tubes (middle section), then to the collecting flue (lowest section). Water and steam travel upward.



GAR WOOD ENGINEERING CO.
4196 Bellevue Ave. Detroit, Mich.

Gar-Wood



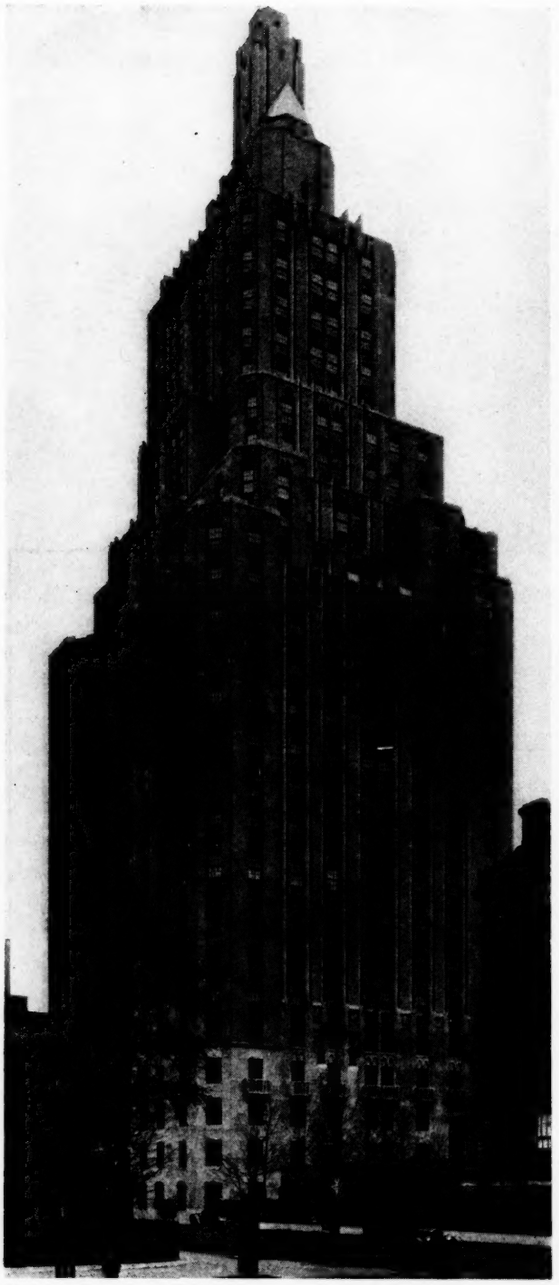
GAR WOOD ENGINEERING CO.
4196 Bellevue Ave., Detroit, Mich.

Gentlemen: Send me...without cost or obligation...a copy of "A New Principle of Generating Heat at Low Cost."

Firm Name

Address

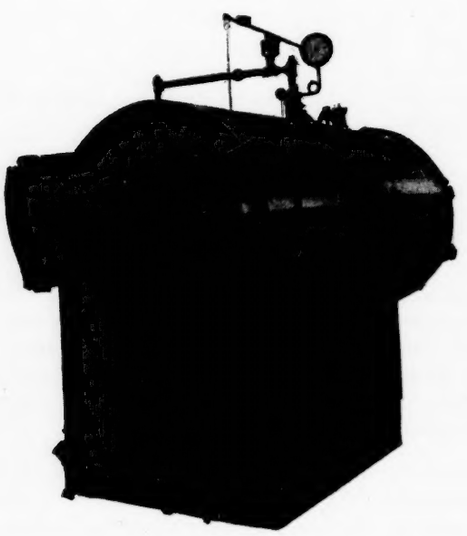
City State H-10-30



No. 1 Fifth Avenue, New York

Fulfilling the Demand of the Most Modern Office Buildings

In no manner does engineering skill make itself so clear as in the skyward reaching buildings of today. Every line—every proportion—tells a story of progress toward efficiency and strength.



Architects: Sugarman & Berger
Helmle & Corbett
General Contractor: Jos. G. Seigal, Inc.
Heating Engineer: W. H. Dusenbury
Heating Contractor: Chas. H. Darmstadt, Inc.

COATESVILLE STEEL HEATING BOILERS

COATESVILLE BOILER WORKS

Boilers - Tanks - Steel Plate Work

Main Office and Works—COATESVILLE, PA.

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Charlotte, N. C. 1717 E. 17th St. | Atlanta, Ga. Bonna Allen Bldg. | New Orleans 1811 Masonic Temple | Dallas, Texas 1505 North Haskell Ave.

Whiting Stoker Economy

A story Bookkeepers everywhere are telling:

The coal account of the Secuset Company of Pittsburgh, Pa., is the same as before they had Whiting Stokers, but now their boiler provides steam for the whole plant while before only for the dye house.

Saved $1,835.36, 6 Months. The books of the South Bend Y.M.C.A. show that Whiting Stokers saved this much for them in coal alone.

Saved $700 a Year. The payroll of the St. Joseph Sanitarium of St. Joseph, Michigan, is reduced this much—they no longer need a night janitor.

Saved $2 a Ton. The bookkeeper of the Rockford Brick and Tile Co. of Rockford, Iowa, will show you these savings right on the journal entries. Whiting Stokers use only screenings.

Definite savings....right on the books in black and white. There are other savings not so easily referred to: labor, cleaning, hauling, steady use of steam. . . . Moreover, all these people who write to us of their savings add: "Our stokers give us perfect service — steady, better heating."

Would you like to see your Coal Account reduced? Would you like to see the savings effected on your fuel pay, in a short time, for the costs of installing this superior firing equipment?

Then find out about Whiting Stokers. Full information will be furnished you on request.

Saved $2,076.76 in 1 Year, in Coal Alone

Books of the Oakwood Rose Gardens, a greenhouse at Oil City, Pa., show these savings with Whiting Stokers:

1927 (hand firing) fuel bill was	$4,595.66
1928 (installed stokers in November)	4,045.84
1929 the fuel bill was just	2,515.90

In 1929, they saved on coal alone $2,076.76—43% of the costs for 1927.

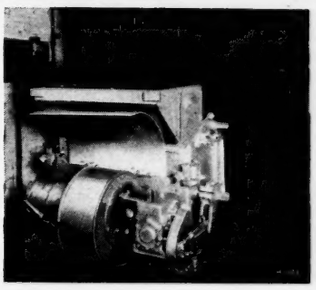
There were labor savings, too.

They maintained a perfectly steady heat—very desirable but never before possible in their greenhouse

You can make savings like this with your boilers and have better heating if you install Whiting Stokers. You really cannot afford not to have this superior firing at these rates of savings. Investigate at once—a note to us is all that is necessary.

(Patented)

WHITING STOKER



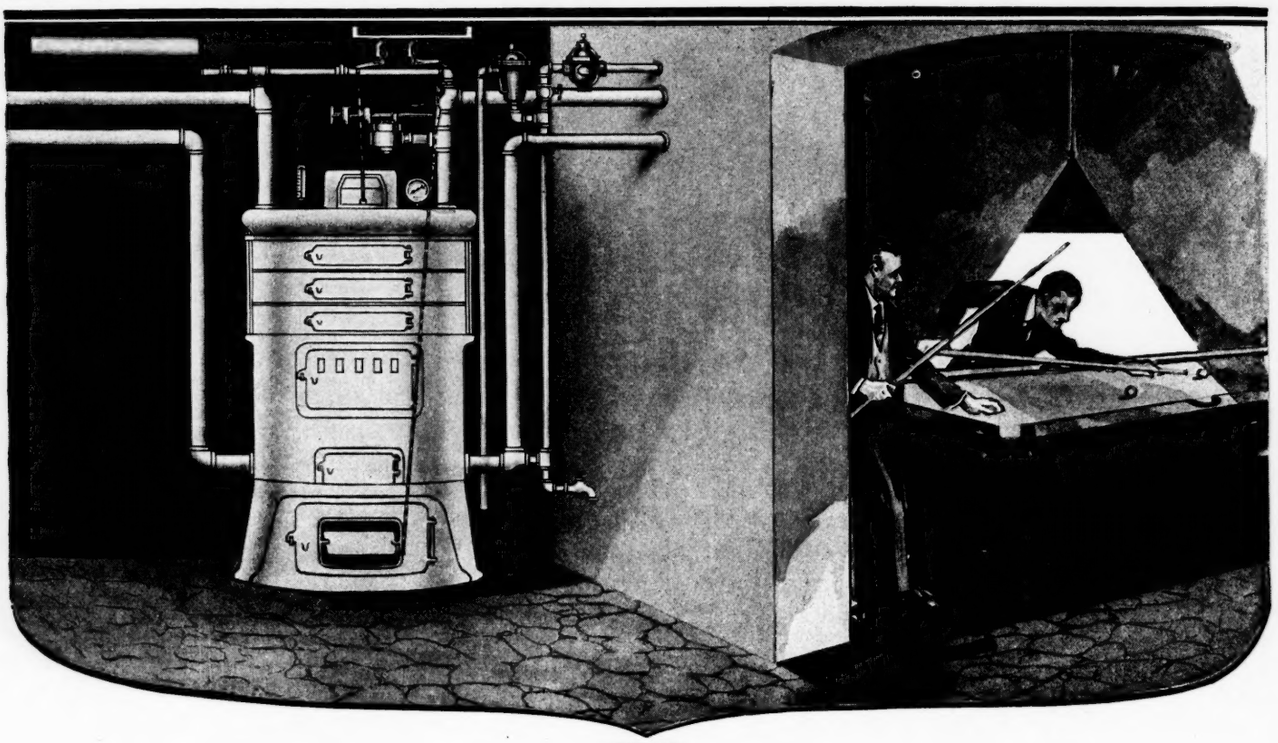
A Model C Stoker installed at the South Bend Y. M. C. A.

Joseph Harrington Co., Subsidiary

WHITING CORPORATION

15695 Lathrop Ave., Harvey (Chicago Suburb) Illinois

IN THE FINEST HOMES



YOU don't have to search for "Thrush System." Walk down into the basement of "the finest home" or in any home, for that matter, where they have had the foresight to install Hot Water Heat, and the chances are that you will find Thrush Equipment installed.

The reason for this is simple. A Thrush Equipped Hot Water Heating Plant is the very best method of house heating. It provides automatic operation, minimum fuel consumption, perfect safety, trouble-free service, and healthful, even heat *everywhere, all the time.*

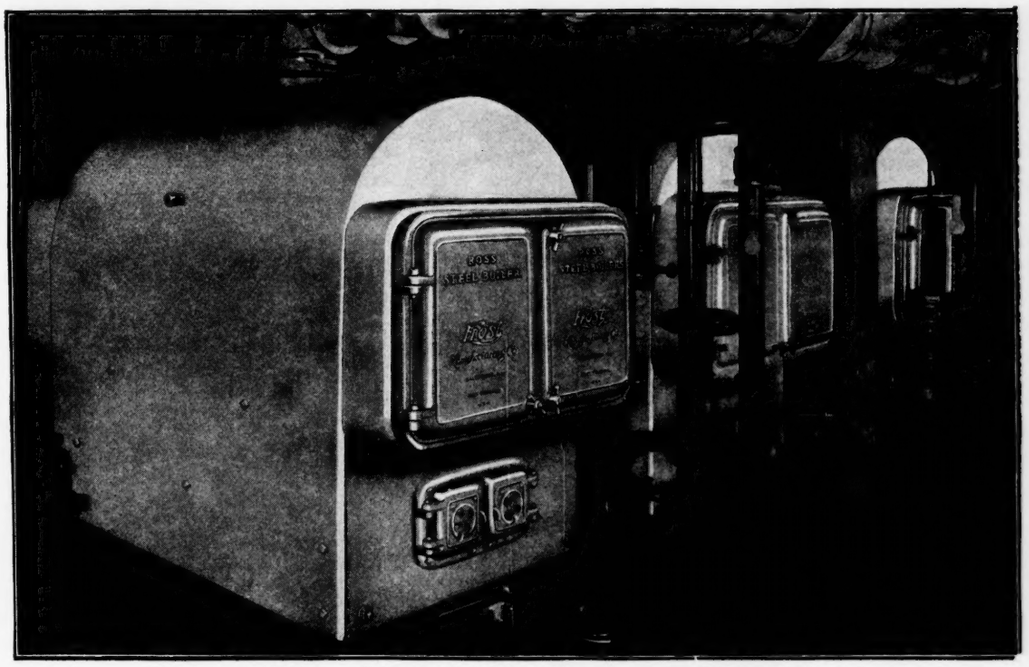
Send for this Book

H. A. THRUSH & COMPANY
Department A, Peru, Indiana

Gentlemen: Please send your booklet "Which Heating Plant for My Home?"

Name_____ Address_____

DEPENDABLE



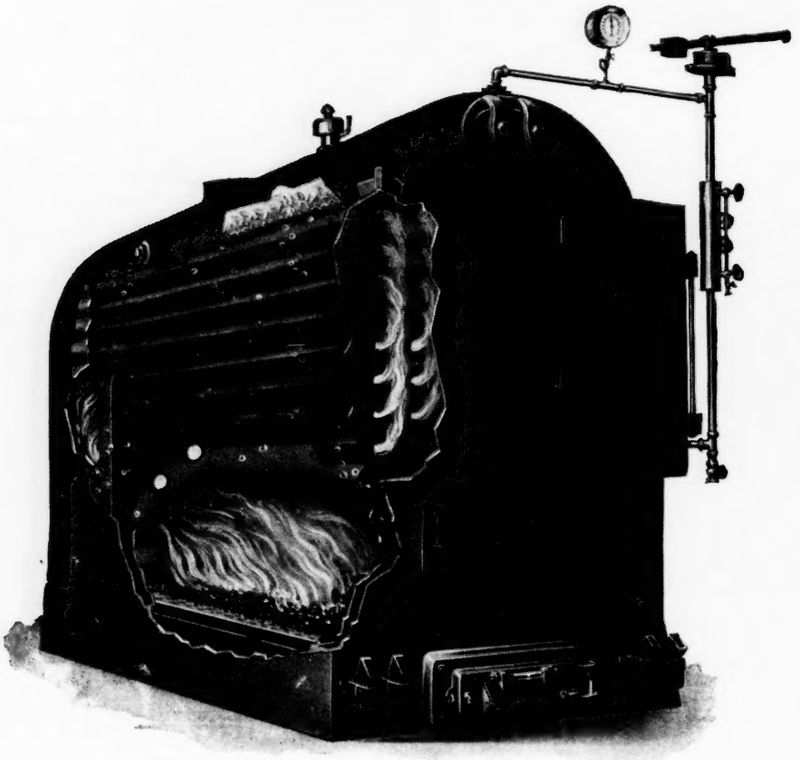
Installation of three 9,000-foot Gas Fired Ross Steel Heating Boilers in the Albert Pike Hotel, Little Rock, Ark.; Eugene Stern, Architect; El Dorado Heating and Plumbing Co., Heating Contractors.

. . . . . In choosing a boiler the growing tendency amongst Architects and Owners is to regard dependability as the first requisite. . . . . The growing preference for Ross Boilers implies a high degree of heating efficiency.

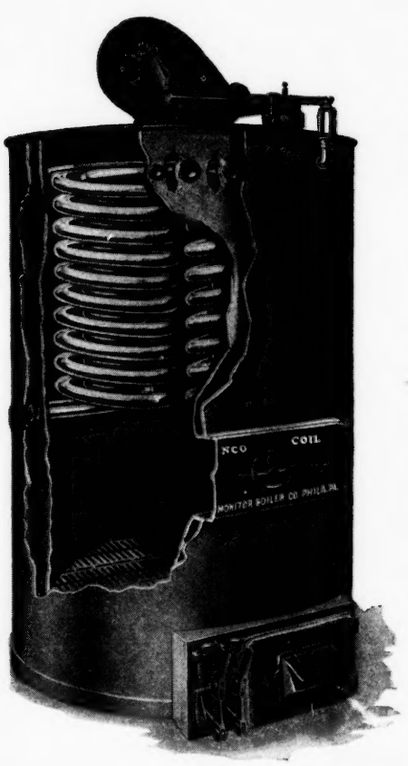
The ROSS STEEL HEATING BOILERS

FROST MANUFACTURING COMPANY
GALESBURG ILLINOIS

MONCO



STEEL HEATING BOILERS AND WATER HEATERS



Economy–Quality–Durability–

that is what **MONCO** *Boilers guarantee*

MONCO Boilers have been developed to their present high standard of efficiency only after years of constant effort. The quality, design and workmanship of **MONCO** Boilers assure a certain guarantee against any repairs for many years. Under the direct supervision of a certified insurance inspector every **MONCO** Boiler is inspected before shipment.

Write to us for complete specifications and details

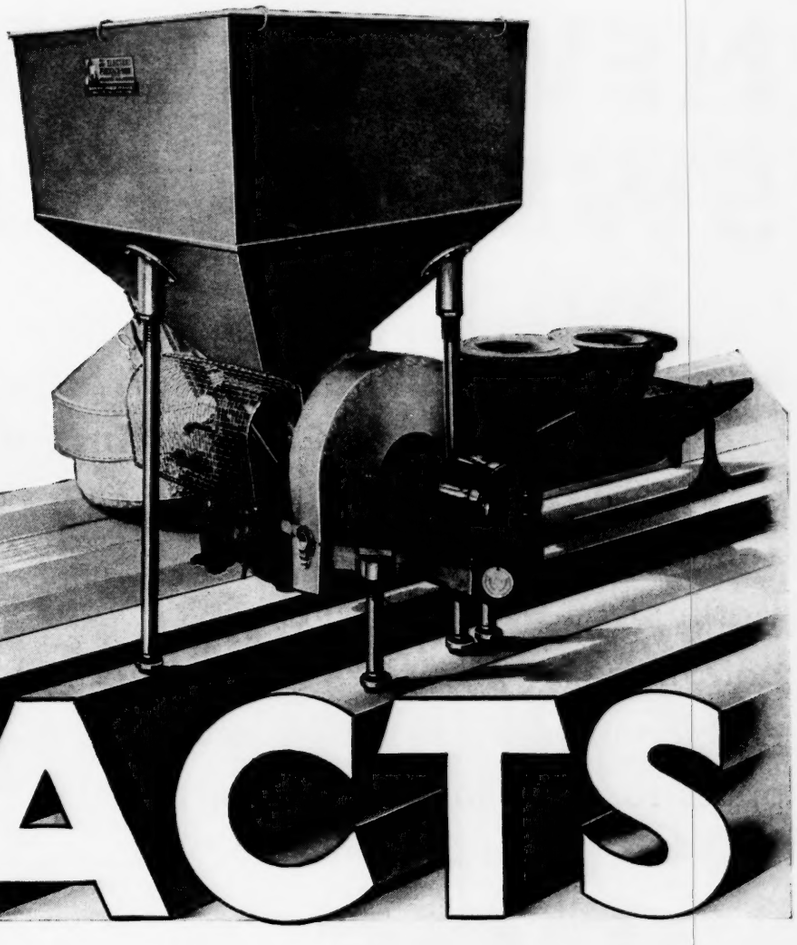
STEEL HEATING BOILERS | **COIL HEATING BOILERS** | **COIL WATER HEATERS**

FOR

COAL OR OIL BURNING

MONITOR BOILER CO., 1505 Race St., Philadelphia, Pa.

Affiliated with UNITED DRY DOCKS, INC., NEW YORK



Success Built on FACTS

Actual performance plus the full recognition and clear, concise presentation of solid, concrete FACTS has established the Electric Furnace-Man as the one outstanding domestic stoker. The Electric Furnace-Man makes ANTHRACITE AUTOMATIC. It makes it possible for homes to continue to use the best and most economical household fuel—PENNSYLVANIA ANTHRACITE—and enjoy the full advantages of automatic heat. Live distributors and dealers are quick to see the great advantages of the Electric Furnace-Man. Their experiences speak for themselves and prove these facts.

The thousands of homes equipped with the Electric Furnace-Man used over 150,000 tons of PENNSYLVANIA ANTHRACITE (Buckwheat and Rice) last year, and reflect the success of our distributor and dealer organization.

The satisfactory operation of the Electric Furnace-Man during years of service in an increasing number of homes, furnishes the most tangible facts, the strongest evidence of the leadership of the Electric Furnace-Man.

AUTOMATIC ANTHRACITE HEAT

There is a model suitable to every domestic heating plant.

The Electric Furnace-Man

(Patented Automatic Coal Burner)

Domestic Stoker Company · 7 Dey Street, New York

NEW OIL BURNER SWEEPS COUNTRY

Homeowners from Coast to Coast See New Radiant Rotary Petro Nokol and Set New Record for Placing Immediate Orders

The users of 101 million dollars worth of our products, thru their patronage and goodwill, have enabled us to stabilize oil burner prices to retail thru our dealers as low as

$295

(Plus Oil Storage Tank)

LIKE wild-fire the news of this important achievement has spread from coast to coast. Just how important it is, you can quickly determine from these brief facts:

27 Years Experience. Petroleum Heat & Power Company is the largest oil heating organization in the world. Since 1903 it has specialized in oil heating exclusively!

Pioneers in Oil Heating. Two pioneers head this nation-wide public service organization. One developed the industrial field. The other designed and built the *first* automatic oil burner to heat homes.

Over 70,000 Users. Today there are more than 70,000 users being served by this company. The cost of these installations ranges from $295 for homes to $60,000 for large industrial and power plants.

Heats Famous Buildings. With a record of success in heating hundreds of such buildings as the Riverside Church in New York City, the Ritz-Carlton Hotel in Boston, the Eastman Kodak Building in San Francisco, as well as the thousands of homes of prominent people, we now offer the trade a model to retail for as low as $295 (tank extra). With such a background, you know this is the greatest value in oil burners today!

Complete Line of Burners. We have a model for every type and size of heating plant and every grade of oil down as low as No. 6. Our dealers have the only "unlimited" opportunity in the industry.

Smart operators will not overlook the advantages representing this complete line in their communities. Full details sent on request.

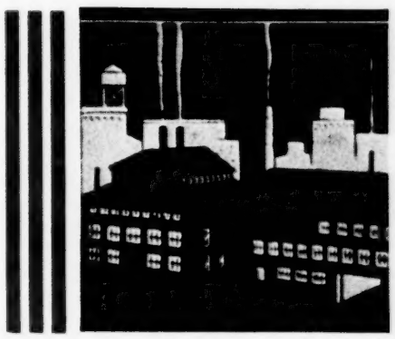
PETROLEUM HEAT & POWER COMPANY

PETRO

General Sales Offices and Factories: Stamford, Conn.

New York, Chicago, San Francisco, Oakland, Los Angeles, Baltimore, Philadelphia, Boston, Providence, Newark, Washington, Tacoma, Portland, Seattle

NO COAL NOKOL



MASSACHUSETTS UNIT HEATERS

BETTER BUILT FOR BETTER SERVICE

UNIT heaters look quite similar but there is a big difference in design—and in performance. Check the following construction features of B & B Massachusetts Unit Heaters and you will know why they give universally satisfactory service.

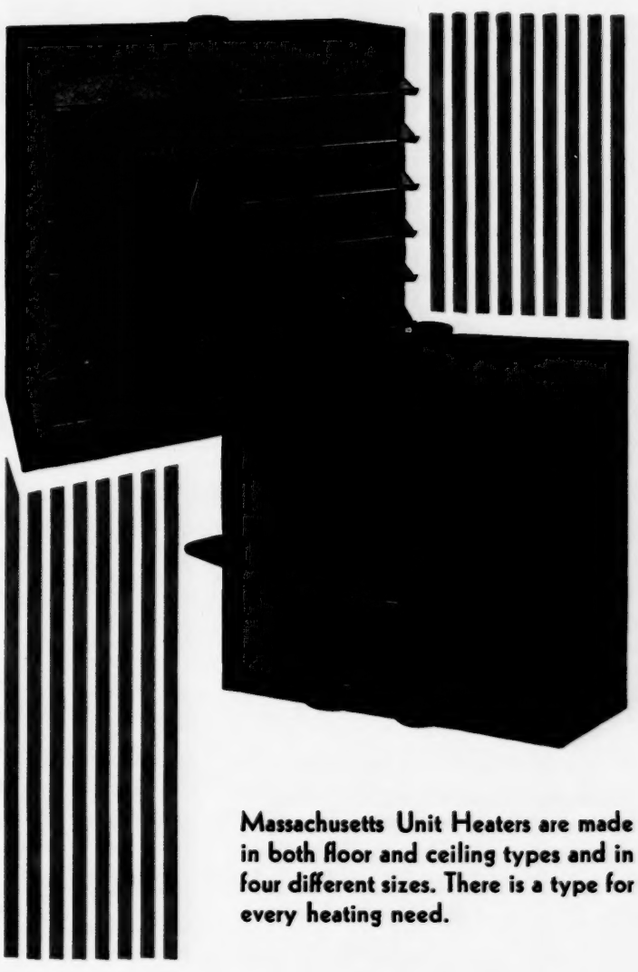
Heater casings—designed with an air space between the fan and heater section, insuring a uniform velocity over the entire heating surface, thus eliminating dead spots.

Propeller fans—produce larger and more uniform air displacement with lower power consumption and quieter operation.

Motors—standard makes, totally enclosed, rigidly mounted and automatically lubricated. Motors are large enough to run continuously without ventilation, insuring them against dust and fumes.

Heating coils—high pressure B & B copper fin radiation, providing maximum surface for heat transfer without undue air resistance. Heater sections are designed to operate on steam pressures up to 125 lbs. per square inch and are tested at 250 lbs. before being assembled.

May we send you our catalog, showing the complete line of B & B Massachusetts Unit Heaters?



Massachusetts Unit Heaters are made in both floor and ceiling types and in four different sizes. There is a type for every heating need.

The BISHOP & BABCOCK SALES COMPANY, Cleveland, O.

General Offices—4901-4915 Hamilton Avenue, N. E.

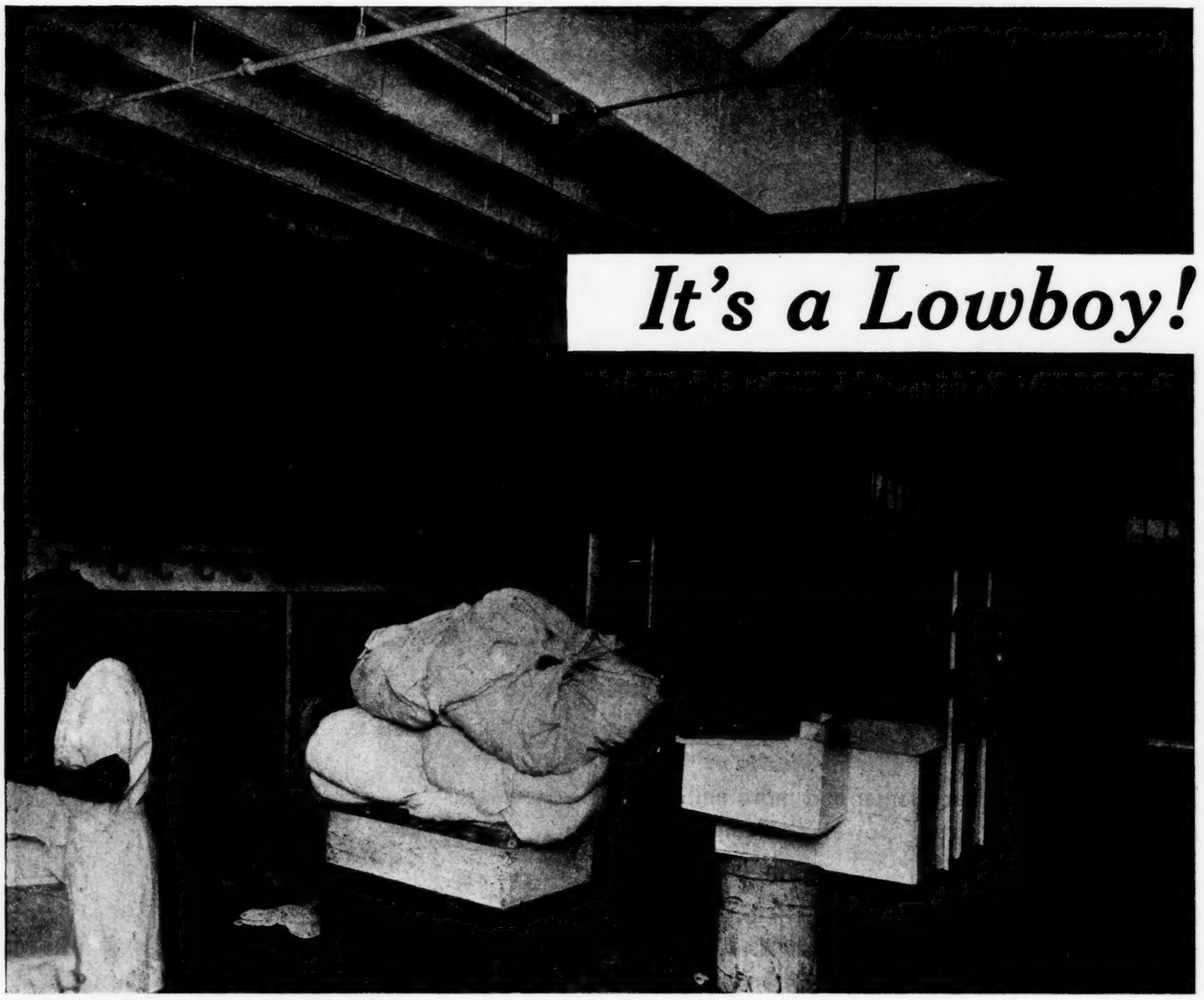
SALES AND SERVICE OFFICES

Baltimore Boston Washington, D. C. Bridgeport St. Louis Buffalo Chattanooga Chicago Cleveland Birmingham, Ala. Denver Detroit Little Rock Los Angeles Minneapolis Duluth Memphis Pittsburgh New York Oklahoma City San Antonio Philadelphia Miami, Fla. Nelsonville, Ohio Orlando, Fla. Springfield, Ill. Winston-Salem, N. C. Richmond Spokane Cincinnati Tulsa Tokyo, Japan

BISHOP & BABCOCK

TEMPERATURE REGULATION

HEATING SPECIALTIES VENTILATING EQUIPMENT



Buffalo "Lowboy" Unit Heater, flat suspended type, installed in a laundry.

and it's husky, good-looking, efficient

The "Lowboy" Unit Heater shown above is one of several similar units installed in this laundry and not only helps keep down heating costs but saves floor space as well.

For plants where floor space is an important consideration, we offer the compact, highly efficient, big capacity "Lowboy." It can be conveniently mounted above factory bins or shelves, along the side walls on brackets in a vertical position or horizontally in roof trusses.

If you are not thoroughly acquainted with the low cost of heating with the "Lowboy" or other Buffalo Unit Heaters, let us send you a copy of our new illustrated Unit Heater catalog.

Buffalo Forge Company

480 Broadway, Buffalo, New York

In Canada: Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

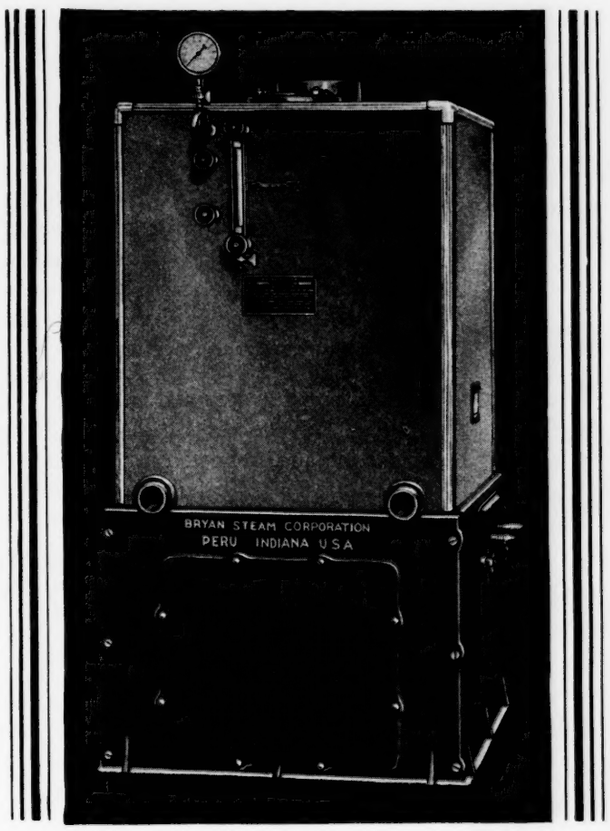
"Buffalo"

Highboys and Lowboys
Breezo-fins and Gas Unit Heaters

THIS SPECIALIZED BOILER

Brings New Economy to OIL-HEAT

• 30% TO 50% LESS FUEL •

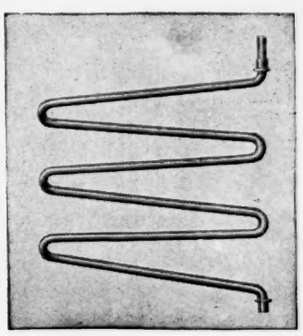


AT THE RIGHT: ***One of the many copper-tube sections which are the keystone of Bryan Boiler performance. These sections break the water into small streams which are driven through the hottest part of the boiler at a very rapid rate, thus absorbing and delivering to dome and radiation more heat in a given time than any other type of boiler.***

TO the home-owner who wants the advantages and convenience of clean, automatic heat—who wants these advantages year after year, without the payment of an excessive premium, the Bryan Copper-Tube Boiler offers the ideal solution.

What the oil-burner must have, for the most efficient and economical operation, is a boiler of such heat-absorbing capacity that it can *absorb* heat as fast as the oil-burner *produces* it . . . Boilers of conventional design were, and *are,* highly efficient for burning coal—but they were not fundamentally designed for burning oil.

Bryan has cast aside coal-burning boiler tradition, and by designing a *new type* of boiler, particularly adapted for oil, has achieved the heat absorption capacity essential to the economical operation of the oil-burner. The result is that oil-burners in Bryan Copper-Tube Boilers *consistently* operate on 30% to 50% less fuel.



If you do not already have complete information on the Bryan Copper-Tube Boiler, please write.

BRYAN STEAM CORPORATION
(Boiler Division)
PERU, INDIANA

BRYAN
Copper-Tube
BOILERS

Boiler Protection is NOW a Certainty...

A NEW device, the *Webster Boiler Protector*, offers a new kind of service to the building owner and heating contractor—*protection* against one of the commonest sources of "grief" in the field of low-pressure steam heating—cracked, broken, or burned boilers, resulting from accidental low water level.

The Need for Protection— All contractors know that the mortality rate for low-pressure heating boilers has been for many years unduly high. Moreover, this condition has grown more acute in recent years because of the increased use of motor-driven return pumps, oil and gas burning equipment.

Practically all failures in low-pressure heating boilers occur as a result of loss of water—failure to maintain an adequate water level, caused by one or more of the following:

Carelessness, lack of a reasonable and desirable minimum of attention.

Priming due to improper piping or failure to provide a thoroughly clean boiler and system.

Failure of complex automatic devices.

Protection against low water line is necessary to prevent damage from these sources.

The Webster Boiler Protector fills this need—It is a dependable safeguard at the minimum water level in heating boilers—a positive *protective* device for use where *protection* is needed.

For five full years this device has been in process of development, tested and re-tested under severe conditions. During the winter of 1929-30 almost 100 installations were subjected to every possible kind of use and abuse. Not until they came successfully up to Webster standards in every detail of performance through a complete heating season was it decided to announce the Webster Boiler Protector for general sale.

Serves as a Boiler Feeder Too— While intended primarily as a *protective* device, the Webster Boiler Protector meets also the specifications for "safety" boiler feeders. Placed three inches below the normal boiler water line its action is extremely positive, because of the

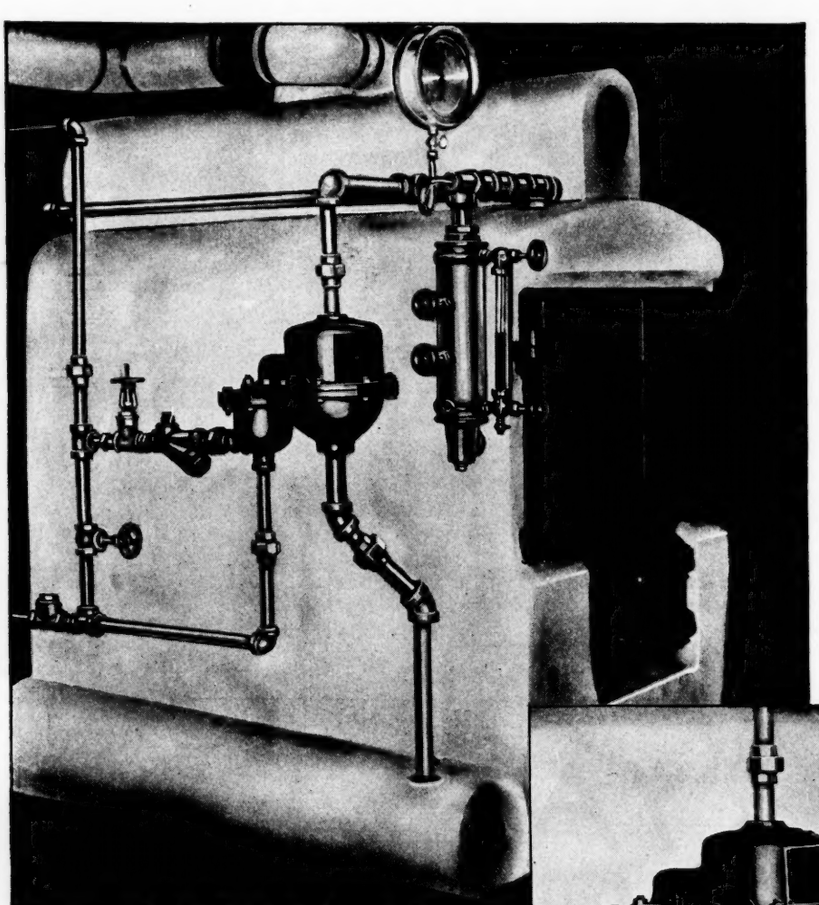


Fig. 1. Above—The new Webster Boiler Protector installed on a low-pressure heating boiler for *protection* against breaking or cracking due to low water level.

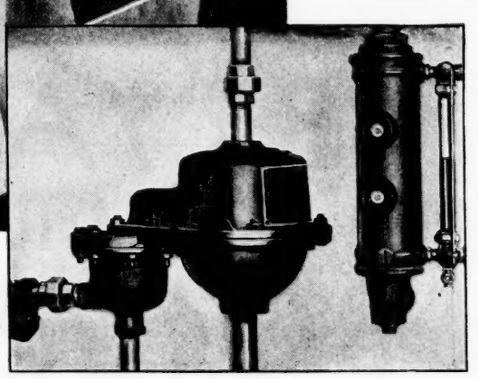


Fig. 2. At left—A closer view of the Webster Boiler Protector showing approximate position in relation to the water line of the boiler.

tremendous power actuating the valve. *You can depend on it, the water will not go below that level.* Danger of flooding is minimized because of its quick action—normally ½″ to ¾″ change in water level suffice for complete shut-off. Where desired, separate over-flow provision may be made at small added cost.

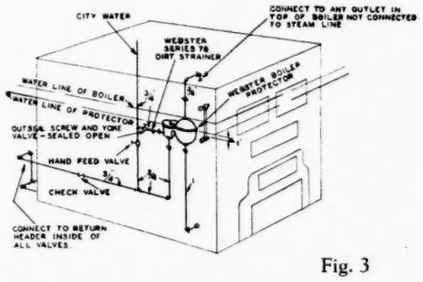

CITY WATER
CONNECT TO ANY OUTLET IN TOP OF BOILER NOT CONNECTED TO STEAM LINE
WEBSTER SERIES 78 DIRT STRAINER
WATER LINE OF BOILER
WATER LINE OF PROTECTOR
WEBSTER BOILER PROTECTOR
OUTSIDE SCREW AND YOKE VALVE—SEALED OPEN
HAND FEED VALVE
CHECK VALVE
CONNECT TO RETURN HEADER INSIDE OF ALL VALVES

Fig. 3

How It Is Installed—Standard method of installation is shown above. Protector is placed 3″ below normal water line, 1″ above bottom of gauge glass. The hand valve is used for feeding water up to normal level. Webster Boiler Protectors can be installed during the winter as only a few hours shut-down is necessary.

How the New Webster Boiler Protector Works—Like a fire extinguisher or sprinkler head, the Webster Boiler Protector is always ready to perform its function of *protection.*

Here is how it works. See Fig. 4 below. City water pressure is maintained on connection (B). Under normal conditions such water pressure exists throughout chamber (C). By reason of the fact that there is a fixed orifice opening (D) the Sylphon Bellows will normally be filled with water at the same pressure. The water valve will be held on its seat by the city water pressure.

When the need for protection arises it is indicated by a falling water line. When this happens the float (G) drops, opening valve (A).

When the ball float drops and opens valve (A) water will immediately discharge through valve (A) in very small quantities into the boiler. While the discharge rate through valve (A) is small it is, however, much greater than the rate at which water can flow through the fixed orifice (D) into the inside of the Sylphon Bellows. There is consequently a definite drop in pressure between inside and outside of the Sylphon Bellows. This pressure difference serves to compress the Bellows, raising the water valve from the seat and permitting water to flow out through the ¾″ pipe connection (E) into the boiler. As soon as the boiler water level has been restored to the safety line at which the Boiler Protector has been installed the float will have risen and shut valve (A). The pressure inside the Sylphon Bellows will then come up to equal that outside and the valve will again seat.

Fig. 4. At right—Operation of the Webster Boiler Protector is positive, quick-opening, quick-closing and noiseless. Repeated severe tests have indicated that the valve simply *cannot be stuck closed* because of the enormous power inherent in the design.

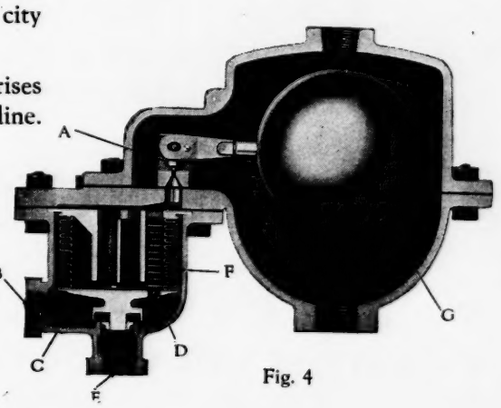


Fig. 4

A New Source of Profit for the Heating Contractor

The Market Is Large

The market for Webster Boiler Protectors is at every contractor's door. They can be sold in *new* as well as *existing* installations; in Webster Vacuum and Type "R" Systems; and in other vacuum, vapor, one-pipe and miscellaneous installations. You can sell one every time you repair a cracked or broken boiler.

Multiple Profits for You

Heating contractors can make multiple profits by pushing the sale of Webster Boiler Protectors. First, a profit on the sale and installation of a device that gives real and valuable service to the owner. Second, profit through the reduction of after-installation "free" service. Third, profit through increasing sales that are sure to result from introducing this *new protection* in your community.

How to Obtain Your Supply

Webster Boiler Protectors may be obtained through the nearest Webster Branch Office. Immediate deliveries. Order one or a half-dozen to safeguard the jobs in your territory. Carry them in stock for emergencies.

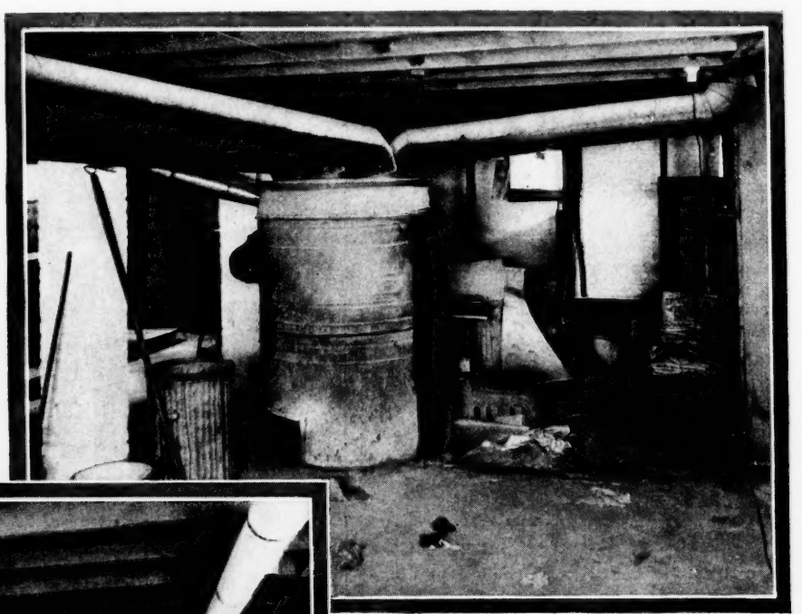
WARREN WEBSTER & COMPANY, Camden, N. J.
Pioneers of the Vacuum System of Steam Heating
Branches in 52 Principal U. S. Cities. Darling Bros., Ltd., Montreal, Canada

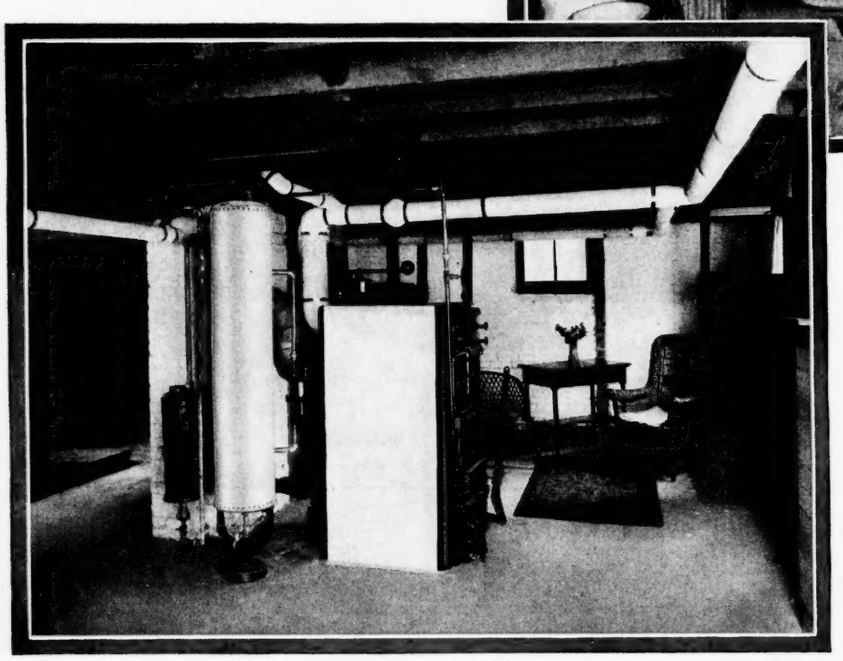
P-1

Made by the makers of

Webster
Systems of Steam Heating
Standard Since 1888

The HEATING CONTRACTOR transformed this basement





Before and after an Ideal Boiler was installed in the home of Mrs. Marie Hermes, Plainfield, N. J. by Heating Contractors Van Zandt and Doeringer, North Plainfield.

...and made a REAL PROFIT

THERE are modernization jobs waiting for you right in your own territory. And even if new building installations are not quite as numerous as you would like—you can still make this a busy profitable season.

Above is an example of how one firm of contractors took advantage of this situation. They have been spreading the gospel of modernization and are now reaping their profits.

Every Thursday night over WEAF and affiliated stations we are telling your prospects this same story and how they can use our time payment plan through Qualified Dealers. Are you getting your share of this business? You can if you will go out after it.

AMERICAN RADIATOR COMPANY

Division of

AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

40 WEST 40th STREET, NEW YORK CITY

SIGNIFICANT!

The new Telephone Building · · The New Department Store
The New Arcade · · The New Garage and the New Bank

all of RICHMOND, VIRGINIA

THE RICHMOND GARAGE
Heated by one Titusville Riveted Boiler

THALLIMER BROS., INC.
Heated by three Titusville Welded Boilers

BROAD-GRACE ARCADE BUILDING
Heated by two Titusville Welded Boilers

CENTRAL NATIONAL BANK
Heated by two Titusville Welded Boilers

CHESAPEAKE & POTOMAC TELEPHONE COMPANY
Heated by two 66 x 16 Titusville Horizontal Tubular Boilers

—Each mindful of its public obligation to guard employees' health and patrons' comfort with *ample heat,*

—Each equipped with every modern facility to keep down operating expense—hence to *heat most economically,*

—And in each, the selection of Titusville Heating Boilers on the basis of efficiency and economy is indeed—

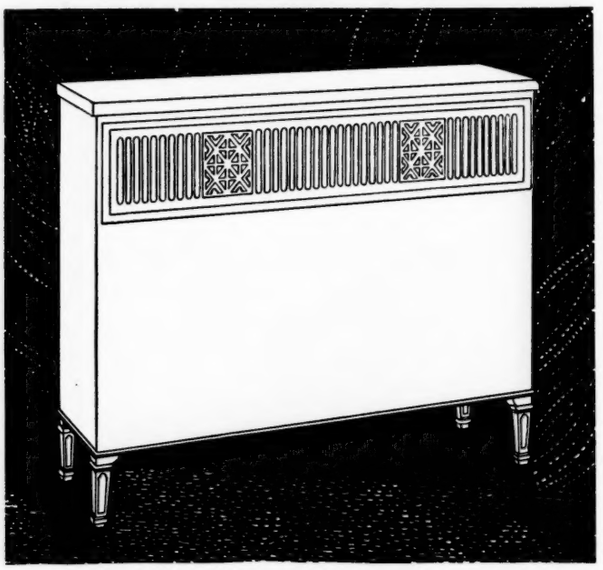
SIGNIFICANT!

THE TITUSVILLE IRON WORKS COMPANY

DIVISION OF STRUTHERS WELLS-TITUSVILLE CORPORATION
TITUSVILLE, PENNA.

A STYLE, TYPE AND CAPACITY TO MEET EVERY REQUIREMENT OF INDUSTRY

TIW-68



HUMIDIFIES . . . . .

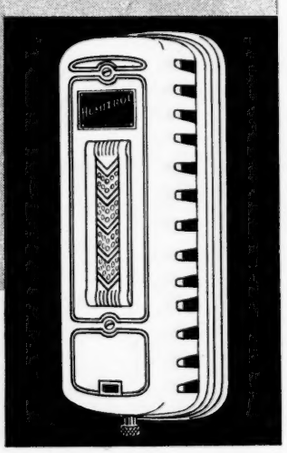
But more than that

CONTROLS HUMIDITY

EVAPORATION is only the first step in air conditioning. Variations in relative humidity due to changing requirements of the air must be controlled. To produce moisture and not to control its volume and its distribution is to accept a compromise rather than a solution to the problem of air conditioning.

● Lewis Air Conditioners place humidity under absolute and automatic control. The patented Lewis Humitrol, an exclusive feature of Lewis Air Conditioners, regulates humidity as accurately and positively as a thermostat does temperature. Lewis Conditioners produce humidity in a vaporous, gaseous form giving rapid and complete diffusion. All air is washed free from dust and impurities in passing through the humidifying section. Through forced recirculation, proper humidity is maintained throughout the house.

● Lewis Air Conditioners are used with hot water or steam heating systems. They are available in attractive cabinet models, in models to conform with modern concealed radiation, and for basement installation and operation.



THE HUMITROL

The Lewis Humitrol looks like a thermostat—acts like one . . . You merely set the Humitrol for the relative humidity you wish to maintain. The entire operation of the Lewis Air Conditioner is governed automatically by this control. Full Humitrol details on request.

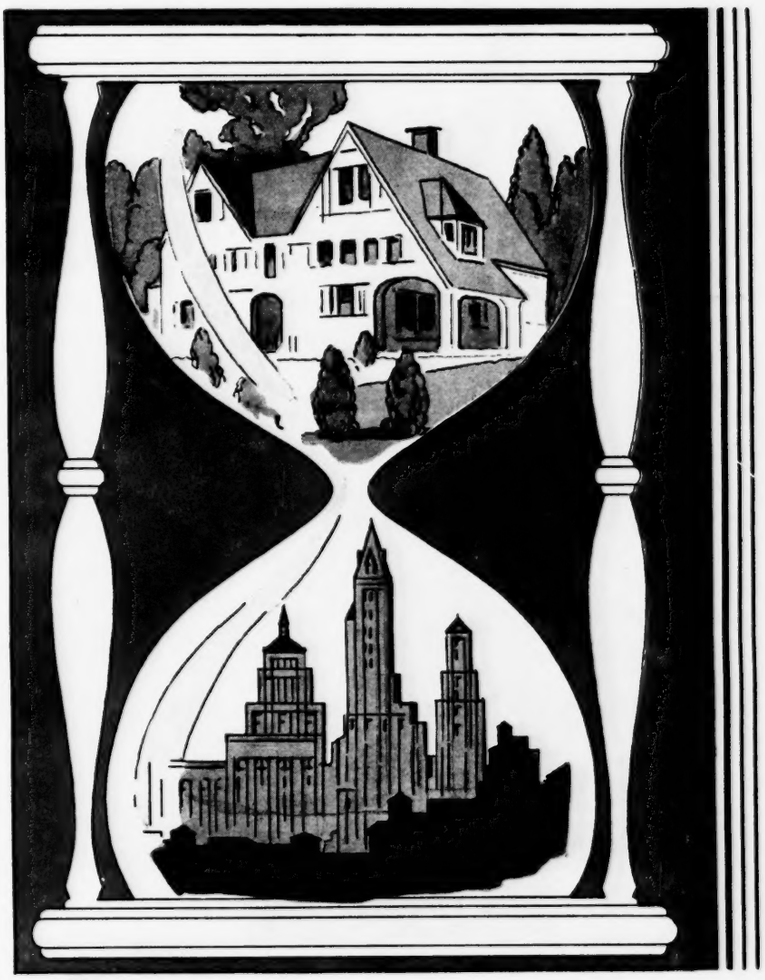
DEALERS WANTED . . . . . .

The field of air conditioning is new — it offers unlimited opportunities for profit. We invite inquiries from live, aggressive dealers who want to get in on the ground floor.

Write for the booklet, "Controlled Humidity and Human Comfort", together with full details on the several Lewis Air Conditioners. The Lewis Corporation, 813 2nd Ave. S., Minneapolis, Minn.

LEWIS AUTOMATICALLY CONTROLLED AIR CONDITIONERS

PIPED *with* "SPANG" means *permanence*



"Spang" Welded Steel Pipe has stood the test of Time in buildings and dwellings alike the world over —millions of feet now in use in plumbing and heating systems are the best evidence of its outstanding excellence.

Made from tough, enduring steel of proper analysis—heated in furnaces of the most advanced type—welded and finished by the latest and best methods and machinery. *Every piece* is rigidly inspected and *every piece* is hydraulically tested to withstand pressures far in excess of actual service conditions—"Spang" Pipe is recommended and specified by leading plumbing and heating contractors everywhere.

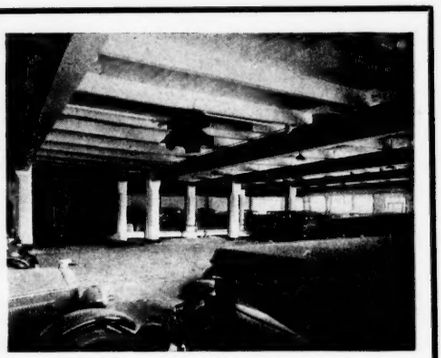
SPANG, CHALFANT & CO., INC.
General Offices: CLARK BUILDING, PITTSBURGH, PA.
Sales Offices: CHICAGO, ILL. NEW YORK, N. Y. ST. LOUIS, MO. PITTSBURGH, PA. TULSA, OKLA. LOS ANGELES, CAL.
Pipe Mills: ETNA, PENNA. SHARPSBURG, PENNA. Seamless Mills: AMBRIDGE, PENNA.

SPANG
WELDED STEEL PIPE

WING FEATHERWEIGHT

For Any Type of Building—At Any Height from Floor

FOR best results a heating system must fit a building—must be engineered into it. Wing Featherweight Unit Heaters are designed expressly for this purpose. They permit the greatest possible range of adaptability.



1. They are located directly over the area to be heated and distribute the air they heat downward in all directions.

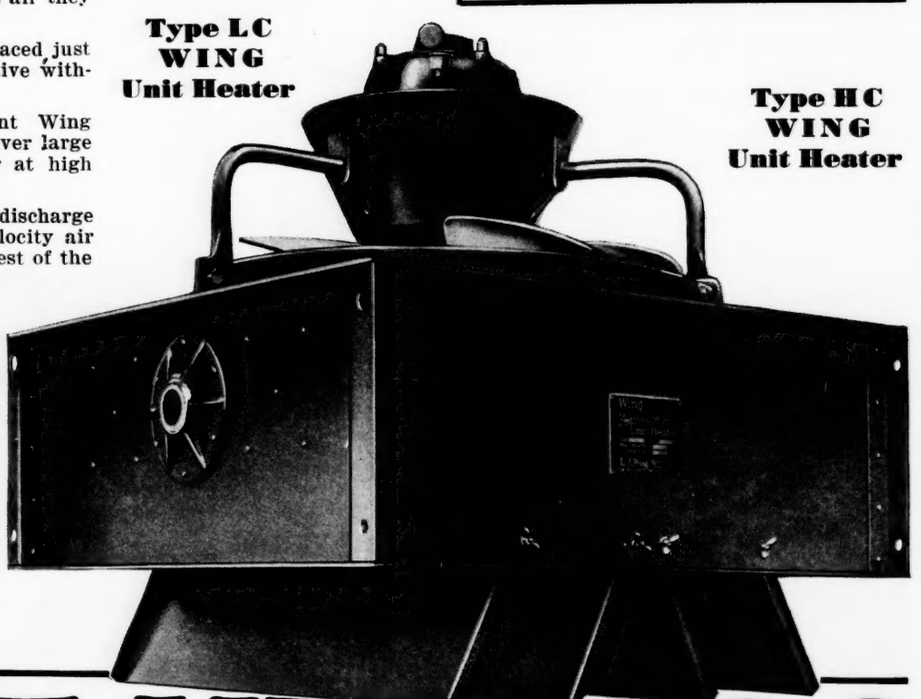
2. They are light enough to be placed just where they will be most effective without expensive reinforcement.

3. They use the highly efficient Wing Scruplex Propeller Fan to deliver large volumes of moderately heated air at high velocity.

4. They use specially designed discharge outlets to deflect this high velocity air current and spread it through the rest of the air in the building, warming the air and setting it in motion.

Type LC WING Unit Heater

Type HC WING Unit Heater



Write for our Booklet

L. J. WING MFG. CO.

Ventilating Fans, Exhausters, Unit Heaters, Fog Eliminators, Motor and Turbine Blowers.

Dept. 10

158 West 14th Street NEW YORK CITY

UNIT HEATERS

PLAIN TALKS ON OIL BURNER PROFITS

No. 6—BALTIMORE DEALER'S 1930 PROFITS EXCEED TOTAL CAPITALIZATION

Three years ago Mr. M. M. Oppenheimer took over the Electrol Franchise in Baltimore, Maryland. He hired a stenographer, an installation man, opened a small office and started to sell Electrol Oil Burners.

Today Mr. Oppenheimer is president of Oil Heat, Inc.—an organization consisting of 3 offices, 3 sales managers, 30 salesmen, an accountant, installation manager and about 30 installation and service men—one of the largest distributors of Electrol Oil Burners in the United States.

Read What Mr. Oppenheimer Says:

There is no mystery about the growth of Oil Heat, Inc. Its success is based on the application of proven business methods to the merchandising of a product that is *right.*

"An Electrol Franchise," writes Mr. Oppenheimer, "properly handled with sound financing, is bound to bring satisfactory returns."

Let the ledgers tell the story: Last year the net profits of Oil Heat, Inc. equalled one-half their total capitalization. *This year their net profits will exceed their total capitalization.*

The Electrol Franchise— and You

This year the mid-summer sales of Electrol Oil Burners were 47% over those of the same period last year. Mr. Oppenheimer is just one of many Electrol dealers whose sales went soaring. All Electrol dealers are making money. The Electrol Franchise can be an open door to profits for you, too.

For the Heating Contractor— a Profit Either Way

1. THE ELECTROL FRANCHISE. There's a nice profit in the Electrol Franchise for the Heating Contractor. This is abundantly proved by the success achieved by many leaders in the business.
2. THE ELECTROL COOPERATIVE PLAN. You will find the Electrol dealer in your territory prepared to make an attractive cooperative arrangement. One that adds to your income; safeguards your professional reputation and requires no extra investment. Let us give you details.

Member of the Oil Heating Institute

ELECTROL

The* OIL BURNER *with the Master Control

227 East 45th Street, New York City

ELECTROL, INC., H
227 East 45th Street, New York
I would like to know more about—
The Electrol Franchise_____
The Electrol Cooperative Plan_____
Name_____
Address_____
City_____ State_____

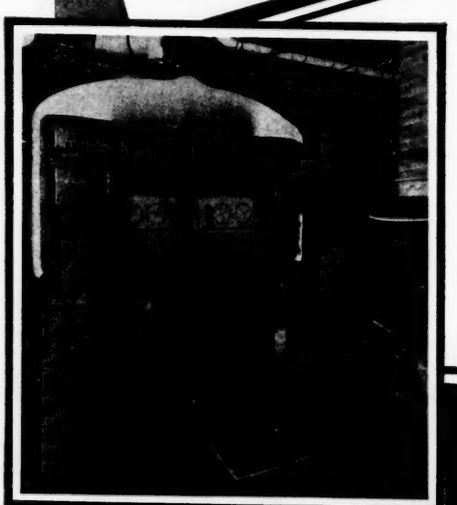
IT PAYS TO SELECT DETROIT JUNIOR STOKERS

FUEL SAVINGS! Saves in many cases from 20 to 30 per cent of coal—a result due to more nearly complete combustion

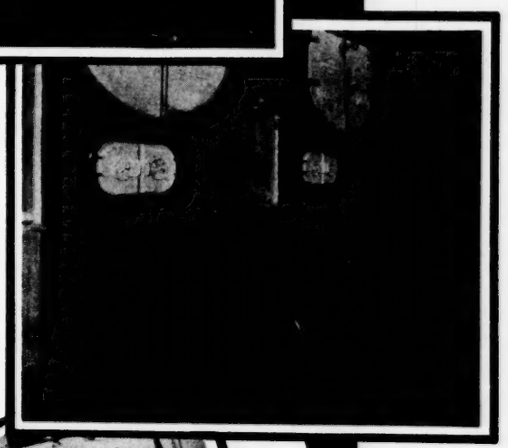
CHEAPER COAL! Burns smaller sized, less expensive coal than is possible with other methods. Savings thus effected may equal the cost of stokers in a year's time.

INCREASE BOILER CAPACITY! Stoker fired boilers may be operated continuously at higher capacities than hand fired boilers. An adequate supply of steam at all times is assured. Frequently it is unnecessary to buy additional boilers as steam demands increase.

SMOKELESS! A clean chimney means a clean, satisfied neighborhood and in compliance with all City ordinances.



PLUNGER FEED—Positive, dependable, correct feed and even distribution



SIDE CLEANING — Boiler room free from smoke, dust and ashes

AUTOMATIC OPERATION! Pressure or temperature control — air supply regulated in proportion to fuel burned. Controls can be set for constant uniform steam pressure or for variations from day to night. Less attention required so operator is free to handle other work about the building.

PLUNGER FEED! Insures positive correct feed, and even distribution within the furnace. Never jams with wet coal.

QUIET AND CLEAN! Stoker gears run in oil bath and are extremely quiet. Dump plates are provided. Hot ashes remain in the pits until cool and can be removed at the convenience of the operator. All smoke and gases are eliminated from the boiler room.

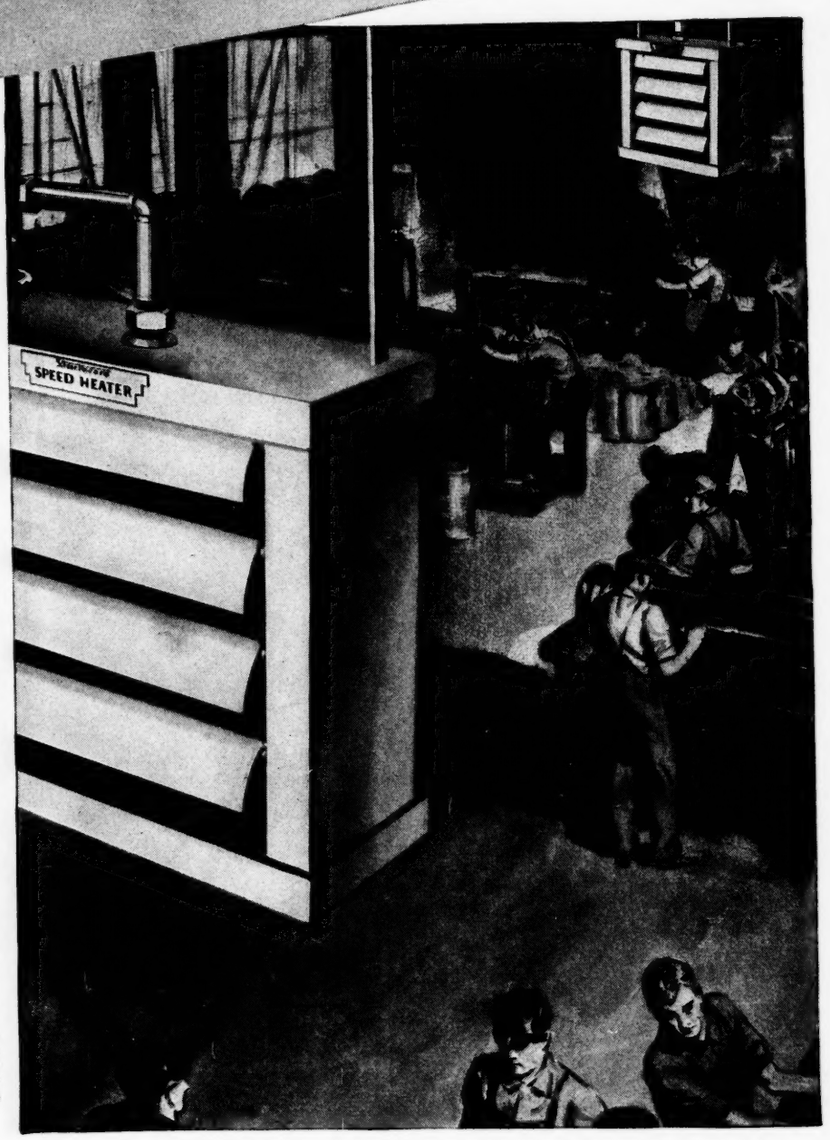
FOR ALL TYPES OF HEATING BOILERS! Built in various widths and lengths to fit accurately all types of heating boilers. Successfully burns bituminous coal from all sections. Write for information, sending details of boiler to be equipped. Request Bulletin 373.

DETROIT STOKER COMPANY
THIRD FLOOR GENERAL MOTORS BUILDING
DETROIT • MICHIGAN
IN CANADA: DETROIT STOKER COMPANY OF CANADA, LIMITED • WINDSOR • ONTARIO

DETROIT JUNIOR STOKER

A TRIUMPH IN COMBUSTION ENGINEERING

O.K. is the country-wide VERDICT!



FEW industrial products have more fully or quickly won the confidence and endorsement of engineers and contractors than Sturtevant Speed Heaters.

In designing the Speed Heater, Sturtevant aimed to turn out a heater unsurpassed in appearance, efficiency and durability. How well it succeeded is indicated by the thousands of Speed Heaters installed and by the high regard in which this equipment is held everywhere.

If you haven't looked over a Speed Heater, we urge you to do so. We feel certain that once you see this equipment you will quickly appreciate the sound engineering and staunch construction built into it. Sample Speed Heaters are on display at most of our offices.

SHIPMENT FROM STOCK

Speed Heaters for all standard voltages, A.C. and D.C., are carried in stock at conveniently located storage points throughout the country. On-the-dot shipment is assured.

The Sturtevant Speed Heater is sold by

CRANE CO.

through dependable heating contractors everywhere.

B. F. STURTEVANT CO.

Main Offices: HYDE PARK, BOSTON, MASS.—CHICAGO, ILL., 410 No. Michigan Ave.—SAN FRANCISCO, CAL., 681 Market St. *Branch Offices in Principal Cities.* Canadian Offices at: Toronto, Montreal and Galt. Canadian Representatives: Kipp Kelly, Ltd., Winnipeg. Agents in Principal Foreign Countries.

—————COUPON—————

B. F. STURTEVANT COMPANY,
(Mail to nearest Main or Branch Office)

Kindly send me a copy of the SPEED HEATER DATA BOOK.

☐ Check here . . . and one of our men will call.

Company.....

Street.....

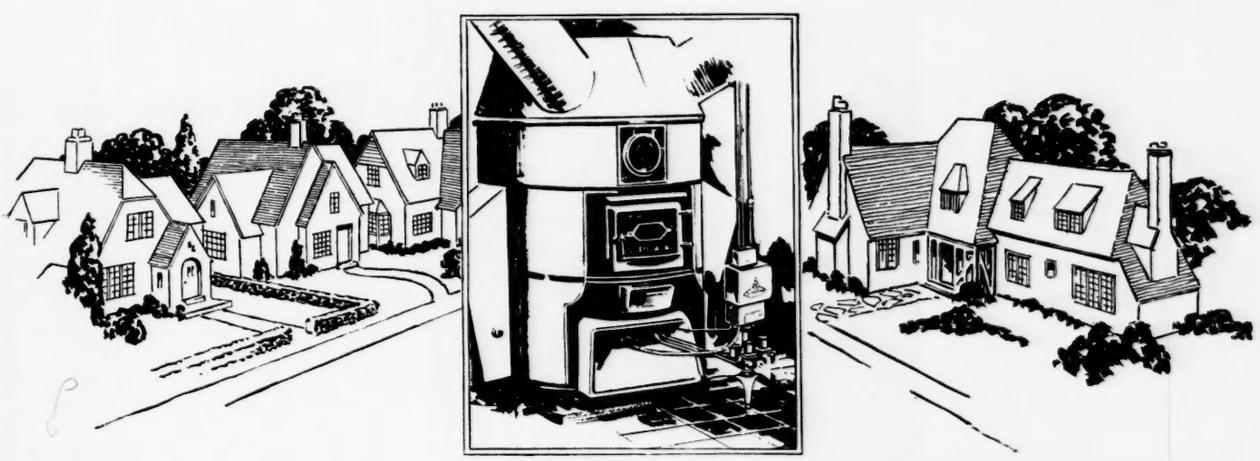
City.....

H.V. 10-30.

Sturtevant
(REG. U. S. PAT. OFF.)

SPEED HEATERS

DON'T do HALF a JOB!



Make every job COMPLETE with a Silent Automatic . . . and pocket two profits!

Determine right now to make Silent Automatic a part of every heating system you install. Every home, old or new . . . every job you've ever put in . . . is a logical "spot" for a "Silent". It can be installed in any type of heating plant . . . hot water, steam, vapor or WARM AIR.

Don't overlook this opportunity to build your profits with the oil burner that has won *world-leadership* . . . and is backed by an unequalled record of "owner satisfaction". With a Silent Automatic you're *sure* to give your customers the year 'round heating comfort they pay for and expect to get.

Your reputation as a heating specialist will be sustained and strengthened by every "Silent" installation you make. Many others in your line of business are "cashing in" on the *growing* demand for Silent Automatics. It's up to you. Send the coupon TODAY.

SILENT AUTOMATIC CORPORATION
12001 East Jefferson Ave. Detroit, Mich.

SILENT AUTOMATIC
THE NOISELESS OIL BURNER

Made by the World's Largest Producer of Domestic Oil Burners

(350)

C O U P O N

SILENT AUTOMATIC CORPORATION

I'm anxious to get your story on how I can make Silent Automatic's great popularity show me a substantial profit. Give me the facts at once.

Name_____

Company_____

Address_____

City_____ State_____

HUNDREDS of OWNERS have ANSWERED these ADVERTISEMENTS

CLEAN EVEN HEAT that is 100% AUTOMATIC

YOU can always have exactly the temperature you desire in your home—and yet be free from furnace tending—if you install an Ideal Gas Boiler. It is entirely automatic and needs no attention from the beginning to the end of cold weather.

And you will have an extra, clean livable room in your basement. There is no soot, no dirt, no ash removal, no noise. And the fuel comes automatically from an inconspicuous pipe.

IDEAL GAS BOILERS

AUTOMATIC HEAT . . . with an EXTRA ROOM

THERE is an extra room in your home waiting for you to use. Your basement can become a livable room—suitable for a playroom, den, workshop, gymnasium or any other use.

There is no soot, no dirt, no fuel storage, no ash removal, no noise. Ideal Gas Boilers burn noiselessly, cleanly and efficiently. And they automatically keep your home at just the temperature desired without any attention from season's beginning to season's end.

IDEAL GAS BOILERS

Mail the coupon below for a free folder that will tell you all about Ideal Gas house heating.

GAS UTILIZATION DEPARTMENT
AMERICAN RADIATOR COMPANY
Division of
AMERICAN RADIATOR & STANDARD SANITARY CORPORATION
40 West 40th St., New York

are you getting your share of the profits?

★ Every day more and more people are answering Ideal Gas Boiler national advertisements. And a recent survey shows that they are buying — too.

Right in your neighborhood there are prospects who want heat that is 100% automatic.

If you make your shop headquarters for Ideal Gas heating, we will be glad to give you complete cooperation and merchandising helps free. Just write us that you are interested. We'll do the rest.

AMERICAN RADIATOR COMPANY

DIVISION OF

AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

40 West 40th Street, New York City

16 pages of vital information and data of interest to you and your company on the outstanding improvement in industrial unit heating recently introduced by Skinner Bros.

Controlling Heat *and* **Heating Cost** *with the* **AIRBLANKET** TRADE MARK

Did You Write for Your Copy?

This 16-page booklet, shown to the right above, compares the new *Airblanket* Method of Heating with ordinary unit heating methods. It explains why this remarkable new principle of industrial heating makes possible greater comfort, efficiency and economy. Write for your copy of this booklet today and familiarize yourself with this outstanding development—it will throw a new light on your heating problems. No obligation involved.

Send for your copy today

It involves no obligation

and may lead to a solution of your problem

Send this Coupon for Your Copy of this Free Booklet

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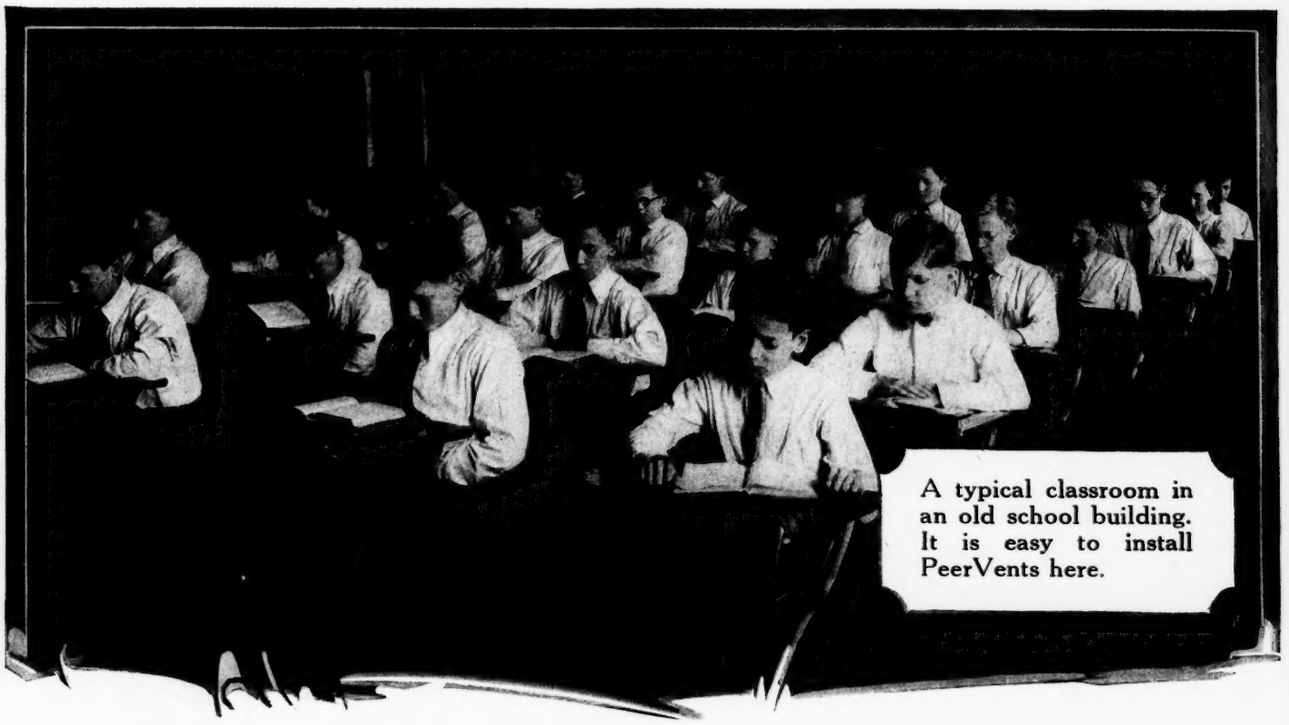
H & V - 10

SKINNER BROS. MFG. CO., Inc.
1402 S. Vandeventer Avenue St. Louis, U. S. A.
Branches in All Principal Cities *"The Originators of Unit Heating"*



A typical classroom in an old school building. It is easy to install PeerVents here.

Architects come back again and again for PeerVents

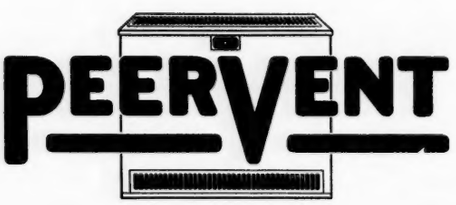
ONCE an architect has tried out the PeerVent System, he finds the service so satisfactory that he invariably recommends PeerVent to his clients for other buildings.

A public school in Hackensack, New Jersey, built in 1914, was equipped throughout with PeerVents. Fifteen years later, or last year, a new school building was completed. The PeerVent System was again installed, so efficient and satisfactory were the original PeerVents.

In Lackawanna, New York, in 1923, Public School No. 3 was PeerVent equipped. In 1924 Public Schools No. 2 and No. 5 were so equipped. Finally, in 1929, four new schools, —the new High School, the Washington School, the Bethlehem School, and the Roosevelt School—were all completely equipped with PeerVent System.

Repeat orders such as these are convincing proof of the satisfactory and efficient operation of PeerVents.

When planning your next school or when remodeling—for PeerVents can be installed in old buildings as well as new—investigate the New Improved PeerVent—ask for a Peerless Engineer to call and discuss your plans—He will have some valuable suggestions for you.

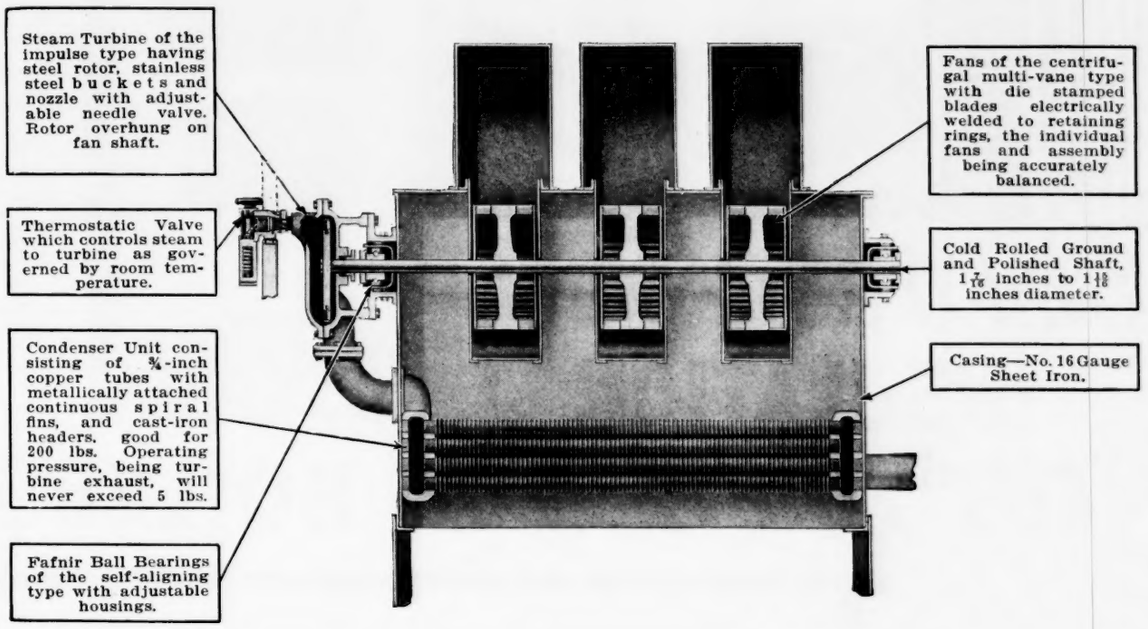


PEERLESS UNIT VENTILATION CO., Inc.
BRIDGEPORT, CONNECTICUT
Pioneers in Unit Ventilation
Resident Engineers in Principal Cities from Coast to Coast

POINTING OUT THE FACTS! AUTOMATIC TURBO HEATER

SAVES AND PAYS BACK IN LESS THAN THREE YEARS, ITS TOTAL COST!!

HOW? Because there's no cost for power — electric current bills wiped out — forever. MORE GOOD NEWS—cost of wiring, conduit, switches, automatic control, fuse box, motor, electrician's and helper's time, etc., etc., also wiped out.


Steam Turbine of the impulse type having steel rotor, stainless steel buckets and nozzle with adjustable needle valve. Rotor overhung on fan shaft.
Thermostatic Valve which controls steam to turbine as governed by room temperature.
Condenser Unit consisting of ¾-inch copper tubes with metallically attached continuous spiral fins, and cast-iron headers, good for 200 lbs. Operating pressure, being turbine exhaust, will never exceed 5 lbs.
Fafnir Ball Bearings of the self-aligning type with adjustable housings.
Fans of the centrifugal multi-vane type with die stamped blades electrically welded to retaining rings, the individual fans and assembly being accurately balanced.
Cold Rolled Ground and Polished Shaft, 1 7/16 inches to 1 11/16 inches diameter.
Casing—No. 16 Gauge Sheet Iron.

Turbo Heater 9 Point Advantage . . . . . .

1. Turbo Heater delivers more efficient heat at half the fuel cost of direct radiation.
2. Eliminates forever cost of electric current for drive. Pays excellent dividends on its cost for a generation.
3. Cost, upkeep and danger of everything electrical dispensed with.
4. Turbo Heater delivers heat independently of possible interruptions of electric power. A very important point, for some industries can suffer severe losses if heat is cut off.
5. Electric motors and fittings are a fire hazard in many locations, where explosive, inflammable dusts, gases, vapors, etc., are present. One can't start a fire with steam. Turbo Heater uses only steam.
6. Compared with old fashioned electric drive unit heaters, Automatic Turbo Unit Heater—saves coal, positively.
7. Steam drives Turbo Heater—the same steam is used for drive and heat, uses no extra steam.
8. Turbo Heater operates on both High pressure and Low. The first and only Unit Heater to operate on Low pressure.
9. The extreme ruggedness and simplicity of Turbo Heater requires no attention except grease at infrequent intervals.

Automatic Turbo Heater Co.

343 So. Dearborn St.
CHICAGO, ILLINOIS

District Representatives

Philadelphia—T. T. Burchfield, 604 Arch St.
Boston—Starkweather & Broadhurst, Inc., 79 Milk St.
New York—Dudley-Curry, Inc., 377 Broadway.
Detroit—Factory Equipment Co., 2245 Blaine St.
Louisville—Simms Thomas, 116 W. Oak St.
Pittsburgh—Frank T. Floyd, 3357 Bigelow Blvd.
St. Louis & Kansas City—Supreme Heater & Ventilating Corp.

AUTOMATIC TURBO HEATER CO.
343 So. Dearborn St., Chicago, Ill.

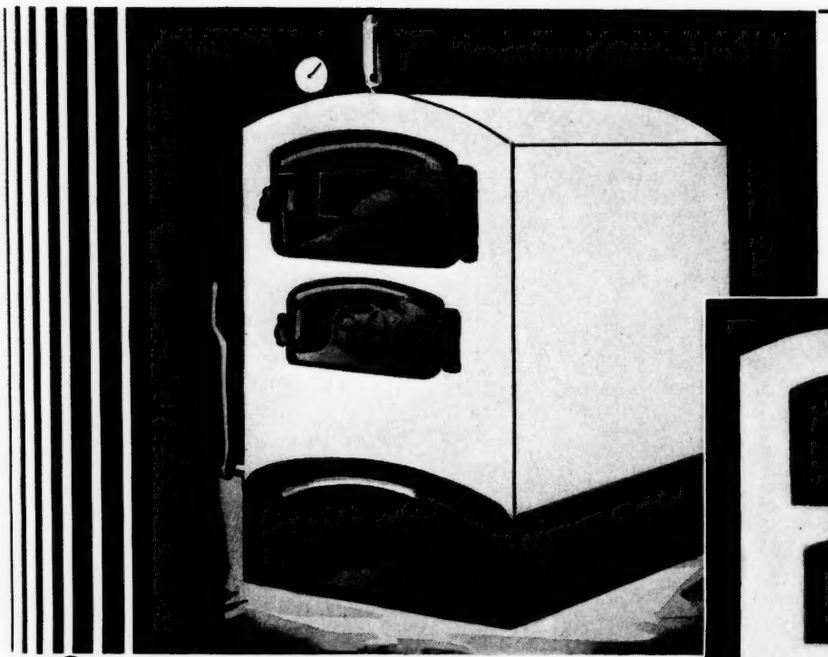
The Automatic Turbo Heater looks interesting. Please send me without obligation all the facts.

Firm .....

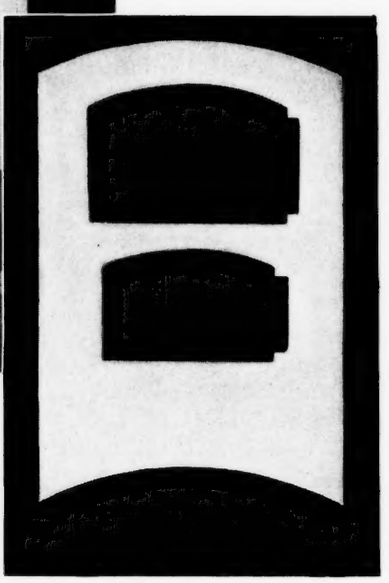
Address .....

..... State .....

Signed .....



INSULATED
BOILERS
SAVE FUEL
and LABOR



Gimco ROCK WOOL INSULATION "CUT TO FIT" FOR BOILERS

Gimco Insulation Pays for Itself!

Quick Facts About
Gimco
Rock Wool
Insulation

1. Low Heat Conductivity — .27 Btus.
2. Low Density—90% trapped dead air spaces.
3. Everlasting as the rock from which it is made.
4. Guaranteed not to sour, smoke or give off an odor.
5. Cut to fit—reinforced. No breakage or waste in handling.
6. No hot spots—When pieces are butted together the resilient fibres intermingle, thereby eliminating hot spots at joints.

Gimco Rock Wool FLEXFELT Insulation is now available in special "cut to fit" sizes, for quick application to domestic boilers. Because of its unusually high efficiency, permanence, flexibility, low cost and ease of application, many boiler manufacturers are turning to these special "cut to fit" sections for application at their factory or shipped in kits along with the boiler for assembling on the job.

Made from silica rock, melted and blown to millions of tough annealed fibres, Gimco Rock Wool Insulation packed to the proper density for commercial use, contains by volume, over 90% dead air spaces. This brings about a heat insulating efficiency rated second to none.

The cost of Gimco Rock Wool Insulation is saved in fuel and labor in two months. And logically, the higher the efficiency of insulation, the more it will save.

When you combine highest efficiency with ease of application, low original cost, permanence and reclaimability, as found in Gimco Rock Wool "cut to fit" insulation, you most certainly have the best possible investment.

You owe it to yourself and to your customers to investigate Gimco Rock Wool "cut to fit" Insulation. Write us direct or consult your boiler manufacturer.

GENERAL INSULATING & MFG. COMPANY
ALEXANDRIA, . . . INDIANA

New York City Chicago Hollywood San Francisco Cleveland Houston Detroit St. Louis Pittsburgh Denver Toronto

Accurate as Electric Time

CLOCKS that have to be wound have a habit of speeding up occasionally and getting ahead of time, and of slowing down now and then and getting behind time. And so, in this modern and efficient world, the clock that has to be wound is replaced by the clock that runs with all the accuracy of electricity itself.

Penn Heat Control

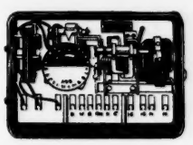
To the field of oil heating, Penn Heat Control brings many new and distinct advantages, not the least of which is electric timing. Developed over a period of three years, Penn Heat Control represents a positive step forward in oil-burner regulation. It has behind it the world-wide reputation of the General Electric Company for the production of dependable parts and equipment.

Lower priced

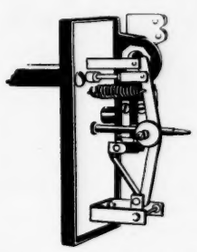
Large scale production makes possible the low price of Penn Heat Control. And yet Penn Heat Control is made to be the finest equipment of its kind. With Penn Heat Control, complete automatic temperature regulation is obtained—maximum safety insured.

Accuracy

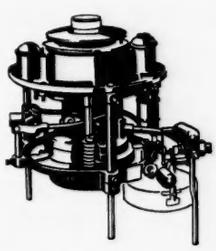
Penn Heat Control is accurate in operation. The thermostat consists of two blades, one for day, the other for night control. The thermostat is so accurately adjusted that the differential in temperature is only one degree. The recycling mechanism repeats itself five times if the flame is not established, and then mechanically shuts itself out. The ignition cut-off is supersensitive, with two to four second operation. The timing is regulated by a Telechron electric motor, which provides constant accuracy and reliability without attention.



Timing mechanism with Telechron motor



Supersensitive ignition cut-off. Two to four second operation



The A. B. C. Automatic Oil Burner

On A. B. C.

A. B. C. Oil Burners are manufactured by a progressive organization that always has been quick to avail itself of improved equipment. Now Penn Heat Control comes on A. B. C. as standard equipment. Through its accuracy and high degree of efficiency, Penn Heat Control brings often greater economy. Manufacturers of more than fifty per cent of all the oil burners produced in the United States are making Penn Heat Control available to their dealers as standard or optional equipment.

Dealers are invited to make their own tests of Penn Heat Control. Address inquiries through your manufacturer, or direct to Penn Heat Control Corporation. Communications with the latter should include the name of the burner. Advice on all heat control problems is always offered. Penn Heat Control Corporation, Franklin Trust Bldg., Philadelphia, Pa.

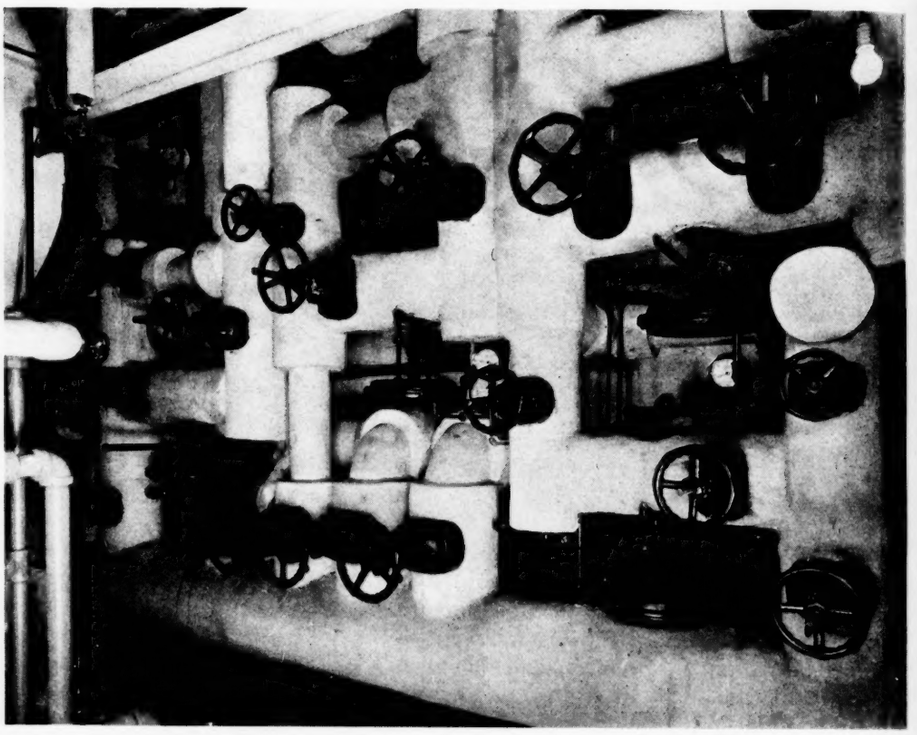
PENN HEAT CONTROL

OBC 11

Listed as standard by the Underwriters' Laboratories

Kieley
Reducing Valves
in the
Hotel Lexington,
New York City

Clyde R. Place, Cons. Engr.
Schultze & Weaver, Architects.
Baker-Smith Company,
Heating Contractors.



QUIET IN OPERATION AND ALWAYS DEPENDABLE

That is one of the reasons why Kieley & Mueller Reducing Valves are found in the largest Hotels and Hospitals.

They give a friendly control and regulation that overcome those old difficulties—leakage, failure to function, and depreciation.

Kieley & Mueller Specialties are desirable in every respect. Efficient when you get them—and dependable clear through their long life—requiring little service and few repairs.

No more lengthy shutdowns. No more frequent calls for new parts. You simply install Kieley Specialties and let them go to work.

Write for the Kieley & Mueller Catalog No. 57. It contains 250 pages of interesting information on Pressure Control and regulation.

KIELEY & MUELLER, INC., 36 WEST 13*th* ST., NEW YORK CITY

Steam Specialty Manufacturers for over 50 years.

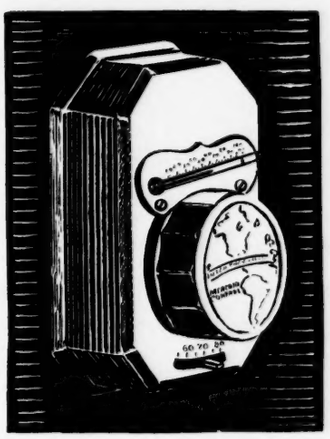
KIELEY

REGISTERED TRADE MARK

STEAM - WATER - AIR GAS SPECIALTIES

MERCOID CONTROLS

MERCOID
THERMOSTAT
A NEW DESIGN
No 855



Used for control of room temperature with Unit Heaters. Beautiful in design and finish. Extremely sensitive. Gives very close control. Positive performance assured Sold at a new low price.

WRITE FOR COMPLETE INFORMATION

THE MERCOID CORPORATION
4201 BELMONT AVENUE. CHICAGO, ILL., U. S. A.
25 CHURCH ST., NEW YORK, N.Y. ▲ 1129 FOLSOM STREET, SAN FRANCISCO

THE ONLY BURNER

LISTED BY THE UNDERWRITERS' LABORATORIES TO AUTOMATICALLY* BURN HEAVY INDUSTRIAL

FUEL OIL NUMBER 6

THIS new Johnson Type 30 Automatic Oil Burner places the Johnson dealer in an enviable position . . . that of selling the ONLY Domestic, Commercial, Industrial oil burner listed* by the Underwriters' Laboratories to AUTOMATICALLY burn industrial fuel oil as heavy as No. 6, preheated when necessary. ◆ But this is not all . . there is a Johnson Automatic Oil Burner of the correct size to heat economically and efficiently the heating or power requirements of every building in his territory . . from the smallest building to the largest commercial or industrial plant. ◆ Then, in addition to selling a complete and superior line of burners correctly priced to enable him to bid on every job, the Johnson dealer knows that the equipment upon which the trademark "S. T. JOHNSON CO." is placed, represents the highest achievement in performance . . . is the result of over 25 years of pioneering and development. And this fact goes without saying, that the organization with a background of 25 years' manufacturing leadership can be looked to with confidence, to also lead the way in sound and aggressive merchandising. ◆ For men of energy and ability we have an unusual opportunity in certain territories. Write or wire for complete information NOW.

*The listing includes the full range of sizes from size 1 ½ to and including size 5 ½ providing a range of from 300 to 27,800 sq.ft. of steam radiation or the equivalent.

JOHNSON OIL BURNERS

For Every Heating and Power Purpose

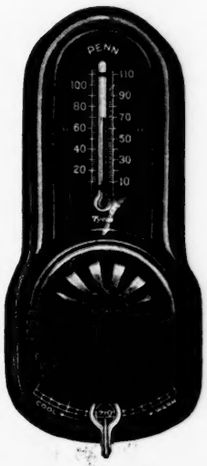
Guaranteed and Manufactured by

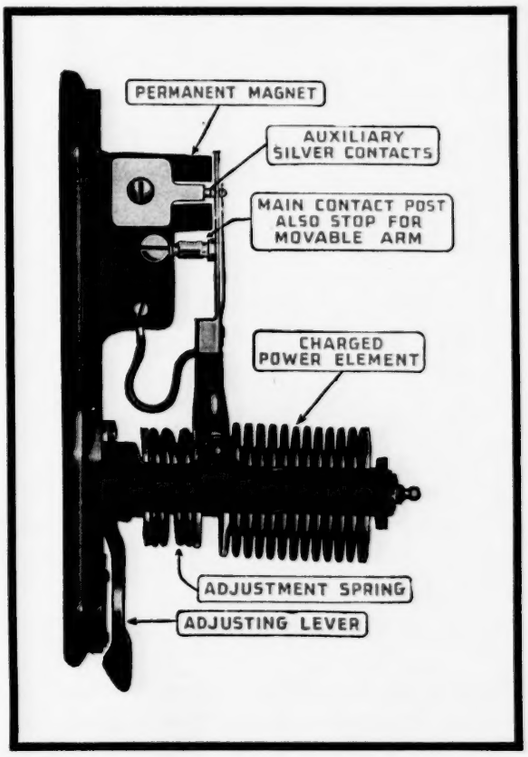
S. T. JOHNSON CO.

Executive Office and Factory: 940-950 Arlington St., Oakland, Calif.
Factory Branches: San Francisco « Sacramento « Stockton « San Carlos, Calif., « Philadelphia, Pa.

MEMBER OF OIL HEATING INSTITUTE

The PENN Thermostat





Study its Amazing Simplicity

JUST glance inside the cover of the Penn Thermostat. You'll see a control that is unusually compact and simple, yet durable and sensitive. A charged sylphon bellows operating the armature and opposed by one main spring constitutes the entire operating mechanism.

Eliminates Mercury Tubes

The armature carries the movable contacts and operates in conjunction with a permanent magnet. This patented contact structure, found only in Penn Thermostats, insures positive snap action, both when opening and closing the circuit, and eliminates the use of fragile mercury tubes. The auxiliary contacts are made of contact silver and located directly between the poles of the permanent magnet. The contact structure, together with the blow-out effect of the magnet, make it possible to carry extremely heavy loads without transformers or relays. The operating principle positively prevents any hovering or tendency toward arcing when opening or closing the circuit.

Proven Performance

In thousands of tests, in Penn Laboratories and actual installations, the Penn Thermostat has proven its unfailing performance. Wherever it has been installed, its simplicity has been admired. You'll like it, too, because it reduces the cost of unit heater installations by eliminating complicated wiring hook-ups and expensive service calls.

Ratings

Type A, charged metal bellows, for 1 H.P., single phase, A.C. and ½ H.P., direct current. Maximum voltage 250. Pilot service 550 volts.

Type AA, Thermostat for current loads up to 30 amperes A.C. non-inductive.

Type B, operated by Bi-metallic metal. Ratings—for 1/3 H.P. motors, either A.C. or D.C., maximum voltage 250. Pilot service 550 volts.

Penn Thermostats have been selected as standard equipment by several of the largest and best known manufacturers of heating equipment in the country. Listed as Standard by the Underwriters' Laboratories.

PENN ELECTRIC SWITCH Co.

DES MOINES, IOWA

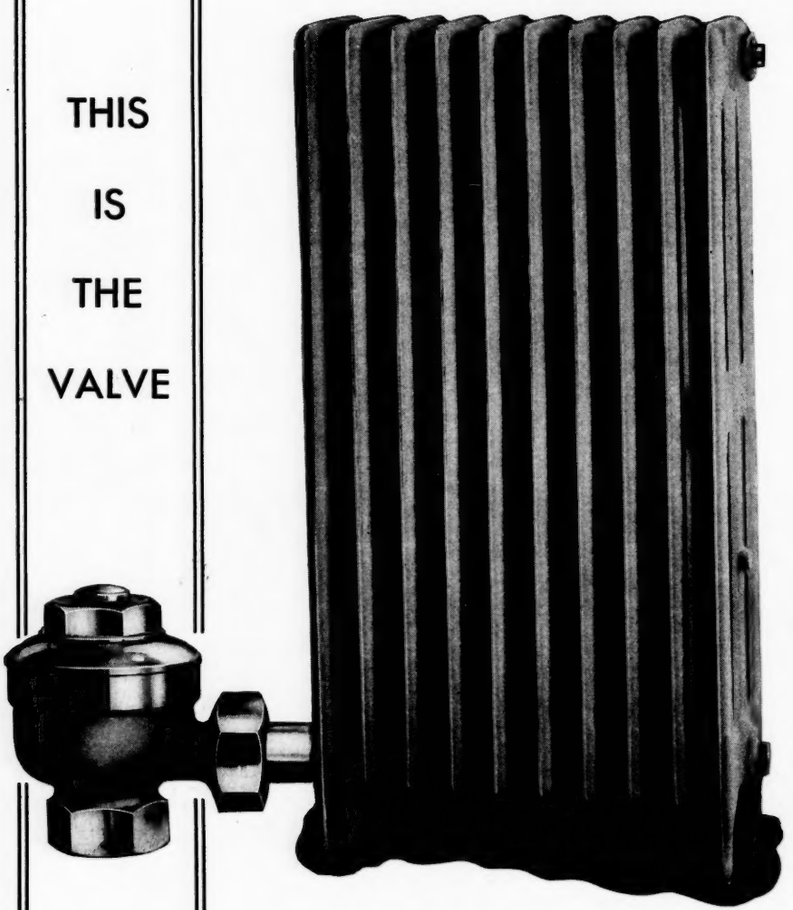
A Complete Line of Automatic Electric Switches for

OIL BURNERS UNIT HEATERS GAS AND ELECTRIC HEATERS

PUMPS AND AIR COMPRESSORS

Barnes & Jones
INCORPORATED

THIS IS THE VALVE



THAT SAVES THE MONEY

Return Valves

This valve on a radiator means money and trouble saved and BETTER RESULTS.

Investigate thoroughly the possibilities of the Barnes & Jones Specialties before specifying equipment.

On thousands of major installations they are "proving up" and they will do the same on the jobs for which you are responsible.

Write for complete detailed information.

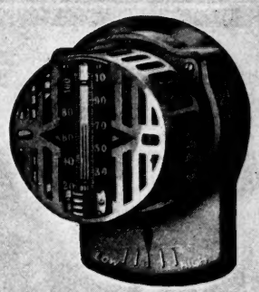
THE SIGN B&J OF QUALITY

Barnes & Jones

128 Brookside Ave., Jamaica Plain, Boston

101 Park Ave., New York City

Home Temperature Regulator



The Time-O-Stat Mercury Switch Thermostat

The TIME-O-STAT Thermostat, sensitive—dependable, assures accurate temperature control at all times. It is equipped with a TIME-O-STAT Mercury Switch and is arranged for low voltage circuits which permits an easy and low cost installation.

The Time-O-Stat Electric Damper Motor

The Damper Motor is sturdy, dependable, powerful and permanently lubricated. Transformer furnished with motor permits low voltage wiring from house circuit to motor and reduces installation costs. Clutch mechanism permits proper adjustment of damper and draft door while firing.

57.50 COMPLETELY INSTALLED

to help you sell home comfort...

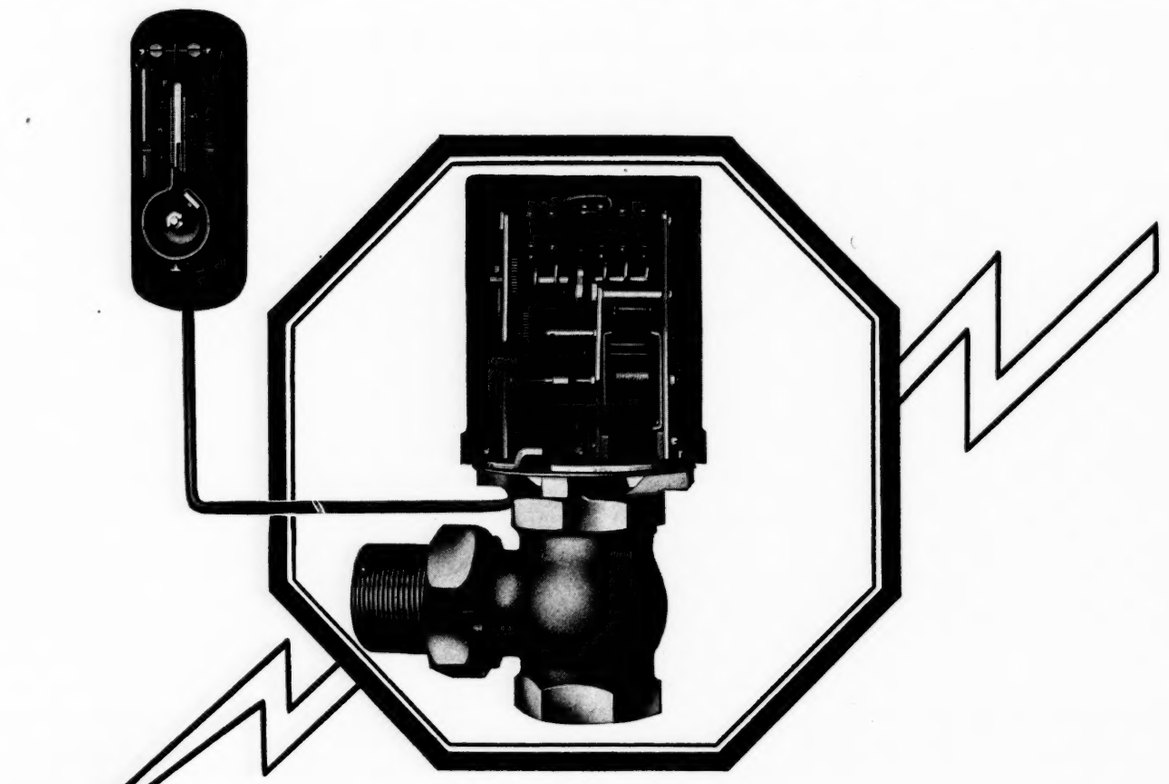
HOME owners everywhere are demanding AUTOMATIC HOME TEMPERATURE REGULATION. They know what even, automatically regulated temperature contributes to healthful living in the home. Convenience and Comfort are more and more demanded as standards of living improve. TIME-O-STAT's Home Temperature Regulator has been engineered for use on all types of coal-fired home heating plants. Your field has unlimited possibilities. Fuel economy is also a big item to thousands of home owners. The initial cost is negligible. Here is an opportunity for immediate installation and quick profits. The motor is furnished complete with transformer, pulleys, fittings and plain or clock thermostat—ready for installation. Write for literature and trade prices.

BRANCH OFFICES
NEW YORK
BOSTON
CHICAGO
EXPORT DEPARTMENT
NEW YORK

TIME-O-STAT CONTROLS COMPANY
ELKHART, INDIANA

EXCLUSIVE DISTRIBUTORS IN ALL PRINCIPAL CITIES OF THE UNITED STATES.
CANADIAN DISTRIBUTORS TORONTO AND MONTREAL.

Manufacturers of Automatic Controls for Oil Burners, Gas Burners, Coal Burners, Electrical Refrigerators, Furnace Fans, Mechanical Stokers, Industrial Ovens, Ice Machines, Unit Heaters . . . also of Sign Flashers, Mercury Switches, Electric Heaters, Corrugated Metal Bellows



The Barber-Colman Electric System of Temperature Control

What it is and what it does

The Barber-Colman Electric System of Temperature Control is a practical method of regulating temperatures by means of room thermostats, which in turn control specially designed motor-operated valves. The difference between this system and others lies in its use of electricity as the operating medium. Each valve operator or damper controller is equipped with a small but powerful induction motor of the shading ring type, designed to operate on 25 volts A. C. This motor has neither brushes nor commutator to produce radio interference. The Barcol System utilizes low-voltage current so the wiring may be easily and neatly installed, even in existing buildings, with perfect safety and at low cost.

This system effectively controls room temperatures within a range of one degree, plus or minus, produces economical fuel consumption whether coal, gas, oil or central station steam is used, and effects a very real saving in maintenance costs. Its rugged construction insures trouble-free operation over many years of useful service. Its use of electricity as the motive power makes the Barcol System thoroughly in keeping with the times, remarkably low in installation and operating cost, and completely dependable.

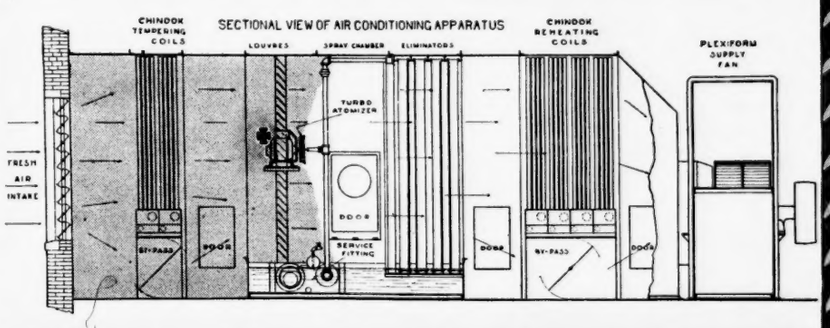
The BARCOL *Electric System of Temperature Control provides equipment for controlling all types of steam jobs with pressures not exceeding ten pounds gauge, all types of indirect heating installations, and the well known split system comprising both direct and indirect radiation, regardless of whether the building is contemplated or done. A strong guarantee insures the owner's satisfaction.*

MANUFACTURED BY

BARBER-COLMAN COMPANY

ROCKFORD, ILLINOIS

FOREMOST *IN ITS Field...*



THE BAYLEY TURBO AIR WASHER

by *Every* Point of Comparison

—non clogging. No fine orifice nozzles to become clogged with entrained solids in the water and cause holes in the water screen.

●

—in place of a bank of fine orifice nozzles; a motor driven centrifugal water sprayer, delivering a water screen the equal of 100 ordinary spraying nozzles.

●

—a single fire type nozzle large enough to permit the passage of entrained solids in the washing water; thus allowing continued use of same water without the use of filters or strainers.

●

—a dense mist screen obtained by directing the water from the single nozzle to a rapidly revolving rotor where it is churned centrifugally into an even, solid spray.

●

—operates with water at only 7 ft. head at nozzle.

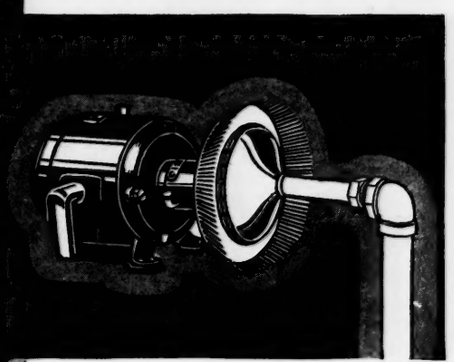
●

—by replacing multiple nozzle banks with Bayley Turbo-Atomizers present inefficient installations of air washers can be made highly efficient.

●

That briefly is the Bayley Turbo-Air Washer. Scores of installations have proven it successful. May we tell you where they are and describe them more fully by means of Bulletin No. 29A.

BAYLEY BLOWER COMPANY
772 Greenbush St. Milwaukee, Wis.



Above the Bayley Turbo-Atomizer. Plan illustration, shows complete Bayley Turbo Air Washer.

Fans — Heaters — Air Washers — Unit Heaters — Heating, Ventilating, Drying, Air Conditioning, Humidity Control, Mechanical Draft.

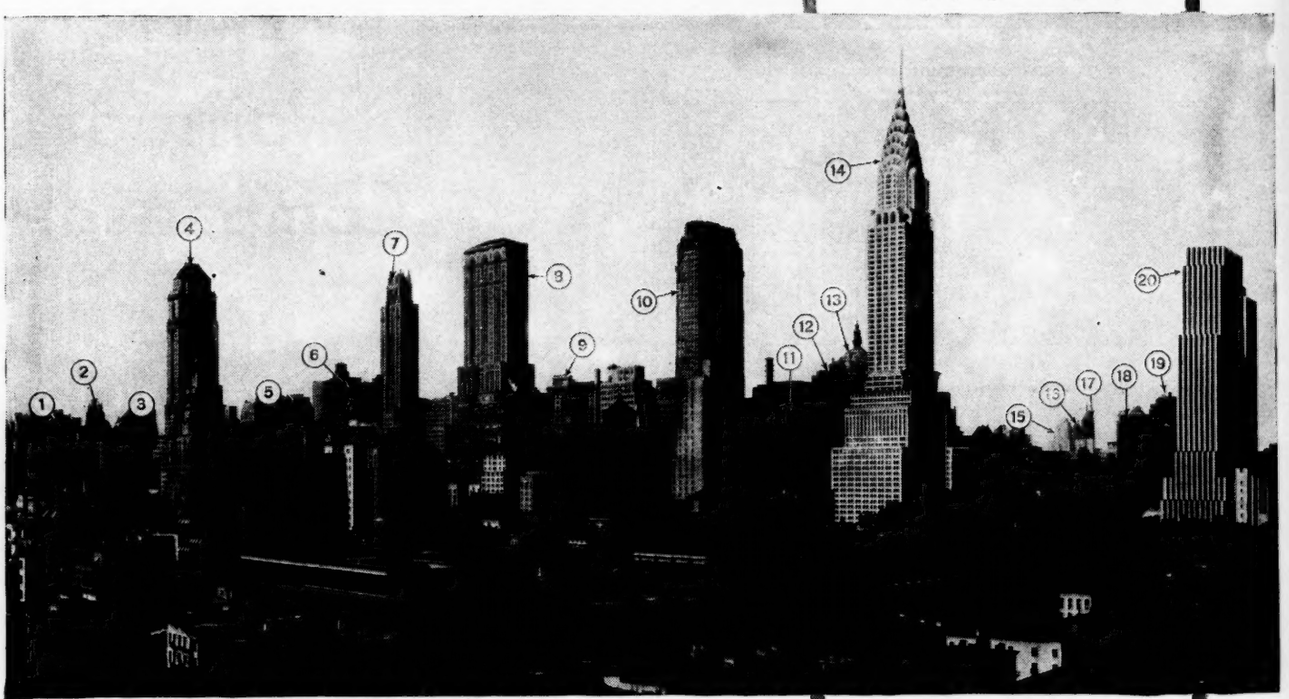
Bayley

TURBO AIR WASHER

JENNINGS ARE THE RULE

Jennings Pumps are installed in:

1. **Fraternity Clubs Buildings**
   1 Duplex Jennings Vacuum Heating Pump
2. **American Radiator Building**
   1 Duplex Jennings Vacuum Heating Pump
3. **Scientific American Building**
   1 Duplex Jennings Vacuum Heating Pump
4. **10 East 40th St.**
   1 Duplex Jennings Pneumatic Sewage Ejector
   2 Duplex Jennings Vacuum Heating Pumps
5. **21 East 40th St.**
   1 Duplex Jennings Vacuum Heating Pump
6. **Murray Hill Building**
   1 Duplex Jennings Vacuum Heating Pump
7. **Lefcourt-Colonial Building**
   1 Duplex Jennings Vacuum Heating Pump
8. **Lincoln Building**
   1 Jennings Duplex Vacuum Heating Pump
   1 Jennings Vacuum Heating Pump
   2 Jennings Condensation Pumps
   1 Duplex Jennings Pneumatic Sewage Ejector
   1 Duplex Jennings Suction Sump Pump



Panoramic view of mid-Manhattan, New York City's new skyscraper section.

in these sovereigns of the skyline

Architects, engineers and owners, in specifying heating pumps, sewage ejectors, house service pumps and sump pumps for fine buildings, turn naturally to Jennings. They know that Jennings equipment can be depended upon for years of efficient, trouble-free service.

In the majority of the towering structures visible in the above illustration, Jennings Pumps are installed.

The Nash Engineering Company, 81 Wilson Road, South Norwalk, Conn.

Jennings Pumps

9. **Delmonico Building**
   1 Duplex Jennings Vacuum Heating Pump
10. **Chanin Building**
    3 Jennings Vacuum Heating Pumps
11. **Commodore Hotel**
    2 Duplex Jennings Vacuum Heating Pumps
12. **Graybar Building**
    3 Jennings Vacuum Heating Pumps
13. **N. Y. Central Building**
    2 Duplex Jennings Vacuum Heating Pumps
    1 Jennings Condensation Pump and Receiver
14. **Chrysler Building**
    2 Duplex Jennings Vacuum Heating Pumps
    3 Jennings Suction Sump Pumps
    2 Duplex Jennings Pneumatic Sewage Ejector
    2 Duplex Jennings Condensation Pump
15. **Squibb Building**
    1 Duplex Jennings Pneumatic Sewage Ejector
    1 Duplex Jennings Vacuum Heating Pump
16. **Savoy Plaza Hotel**
    4 Duplex Jennings Vacuum Heating Pumps
    2 Jennings Suction Sump Pumps
17. **Sherry-Netherland Hotel**
    4 Jennings Pneumatic Sewage Ejectors
    2 Jennings Condensation Pumps and Receivers
    1 Duplex Jennings Vacuum Heating Pump
18. **Bartholomew Building**
    1 Duplex Jennings Vacuum Heating Pump
19. **Shelton Hotel**
    2 Duplex Jennings Vacuum Heating Pumps
    1 Jennings Vacuum Heating Pump
20. **Daily News Building**
    2 Duplex Jennings Vacuum Heating Pumps
    1 Jennings Vacuum Heating Pump

JEFFERY-CYRIL APARTMENT
BUILDING
71st Place and Jeffery, Chicago
Paul F. Olsen, Inc., Architect
Adelman Heating Co., Heating Contractor

S. T. Johnson Oil Burners and Raymond Duo-Stat installed by S. T. Johnson Oil Burner Co.

By controlling the oil burner from a *combination* of Outdoor Temperature and Radiator Temperature the one DUO-STAT in this building keeps every radiator continuously supplied with just the amount of heat needed, according to the Outdoor temperature.

Controlled by the Outdoor Temperature

There's magic in Outdoor Temperatures. Actually its use as a medium for controlling heating systems inaugurated a *New Era* in heat regulation apparatus. Today it is used by the foremost engineers to obtain results which were never before possible.

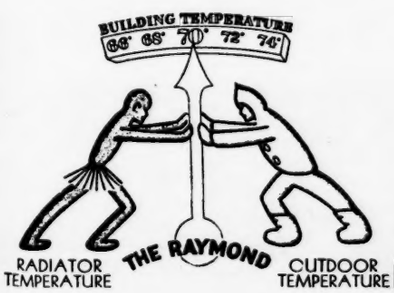
But Outdoor Temperature *alone* is not enough. Perfect heat regulation requires radiators being maintained at the varying temperatures which will offset, or balance, the heat losses.

The DUO-STAT uses Outdoor Temperatures. But it goes further and uses a *Combination* of Outdoor Temperature and Radiator Temperature to control the Oil or Gas Burner, Coal Stoker, or Automatic Steam Supply Valve.

In this way it "flattens" the heat supply curve, so that radiators instead of getting too much heat part of the time and no heat the rest of the time, are continually supplied with an amount of heat proportional to the temperature outdoors.

Not only does the Duo-Stat give this ideal kind of performance from any ordinary steam, vapor, vacuum or hot water heating plant but by *eliminating overheating* it saves from 20 to 30% of the fuel which would be used without it.

The building shown is just one of 700 where the Duo-Stat is doing just that. *Send for our new Bulletin, No. 3, just off the press.*



THE RAYMOND
DUO-STAT
F. I. RAYMOND COMPANY
228 North La Salle Street Builders Bldg. CHICAGO

THE WORD SERVICE IN THIS COMPANY'S NAME IS SIGNIFICANT

The word "Service" in this company's name applies to the installation of Johnson Heat & Humidity Control by no one but Johnson Service Company men, and under Johnson supervision.

It implies the efficient performance of Johnson apparatus always.

It includes voluntary, free inspection of each job once a year.

It assures emergency attention within twenty-four hours time.

It means the company's guarantee of attentive interest in the installed apparatus as long as it exists; permanently responsible.

It embraces constant effort toward improvement in Johnson apparatus; every notable advance in temperature regulation during the past forty-five years having been of Johnson conception.

The word "Service" is indeed significant in this company's name.

JOHNSON SERVICE CO.
Established 1885

149 E. Michigan St. MILWAUKEE, WIS.
BRANCHES IN ALL PRINCIPAL CITIES

The All-Metal System.

The All-Perfect Graduated Control of Valves and Dampers.

The Dual Thermostat (Night & Day) Control: Fuel Saving 25 to 40%.

Schoellkopf, Hatton & Pomeroy, Inc. Building . . . . Buffalo . . . . New York
Edward B. Green & Sons, *Archts.*
L. A. Cherry . *Consulting Eng.*

Johnson Dual Thermostats control the direct radiators in the various offices of this building: automatically maintaining constant normal temperature during the occupied periods of each office, and a lower temperature when vacated and unoccupied (at night, for example). In addition, Johnson Control is on the mechanical ventilating system of the building. Fresh air intake and vent dampers are operated by Johnson Pneumatic Switches. A Johnson Humidostat and Johnson Grid Humidifier insure proper humidification of the air entering each room of the building.

JOHNSON HEAT AND HUMIDITY CONTROL

Won't you let us prove this statement?

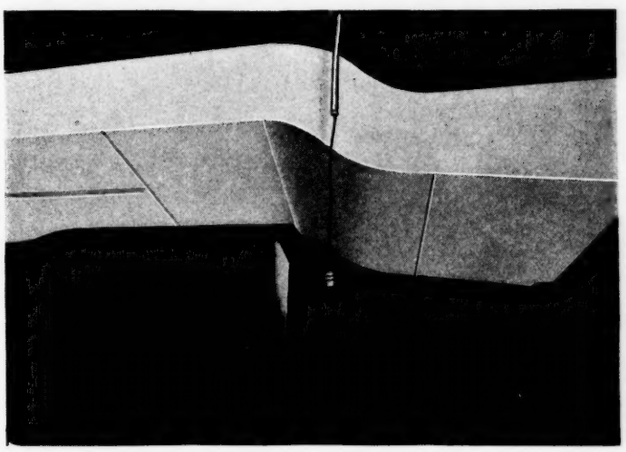
"Whatever may be your insulation needs—they will best be served by the use of Mineral Felt Products."

H. B. Russell

PRESIDENT—The Mineral Felt Insulating Co.

MINFELT INSULATING CEMENT

for Ducts, Fittings, Breechings and Stills



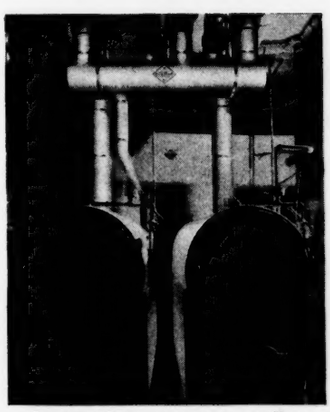
Minfelt Cement is being extensively specified for insulating the heating and ventilating ducts in many public schools and buildings.

Its uses are almost universal. It is the best and most practical insulation for the covering of fittings, heating and ventilating ducts, fire doors of boilers, and for innumerable other places where a cement form of insulation is preferable. It is always used as the finishing coat in connection with Pyrofelt Block installations. It can be used to advantage on irregular surfaces of all kinds, or on any job where especially quick work is demanded.

Is light, resilient, vermin-proof and fireproof. Has practically no shrinkage. Sticks to any clean surface. Easy to mix and apply.

Pyrofelt Insulating Blocks

for Boilers, Breechings, Ovens and Refrigerators



Improved appearance as well as utility will be found in Pyrofelt.

The most efficient block form of insulation available. Pliable and resilient.

Fits perfectly to uneven surfaces, preventing convection losses.

Vermin-proof, fireproof, vibration-proof, and moisture-proof.

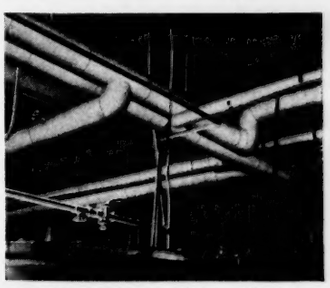
Not affected by acids, alkalis, fumes or smoke — no corroding action on metal.

Minfelt Pipe Coverings

for Steam and Refrigerating Lines, Interior and Exterior Use

The perfect fit of the covering to the pipe surface eliminates convection heat losses. The perfect contact between sections eliminates heat losses caused by open joints.

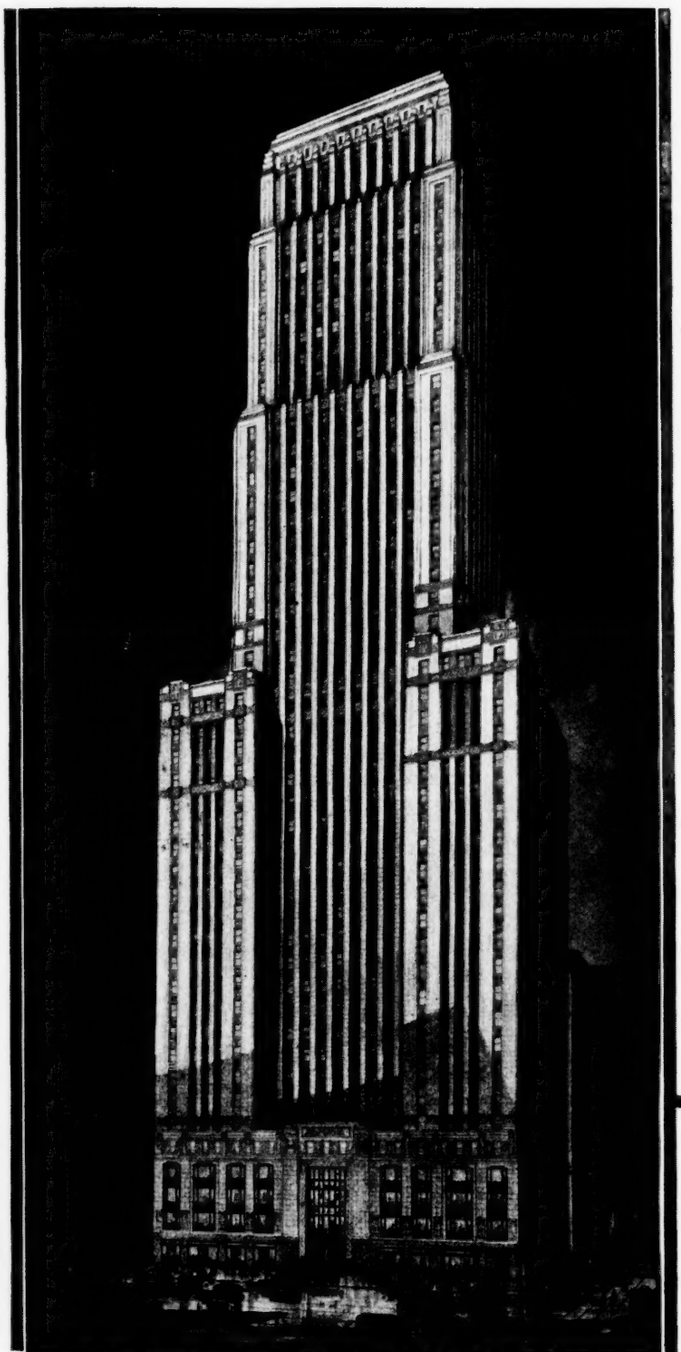
The unusual savings secured as a result of using Minfelt Pipe Covering are many times the initial cost. The additional saving over other insulating materials, in many instances, has paid back the entire cost of the job within twelve months' continuous use.



Minfelt Pipe Coverings offer you unusual economy and long life.

The Mineral Felt Insulating Co.
2225 Albion St., TOLEDO, O.

MINERAL FELT



K. M. Vitzthum & Co.
Architects

John D. Small
Consulting Engineer

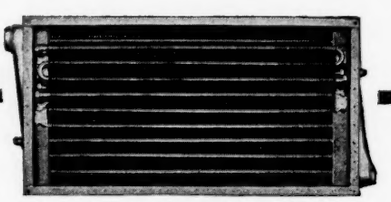
Mehring & Hanson Co.
Piping Contractors

American Blower Corp.
Fan Apparatus

— and in Chicago's magnificent financial and commercial center, the

ONE LA SALLE STREET BUILDING

AEROFIN *is the* Heat-Surface



The Standardized Light-Weight Fan System Heat-Surface

4 Types 196 Standard Sizes

Pressures up to 350 lbs. gauge

Unit illustrated in section is

UNIVERSAL AEROFIN, *2½ to 200 lbs.*

Any Office will gladly render prompt, efficient, technical cooperation

Newark will be glad to send informative and appropriate publications upon request.

Please mention where you saw this advertisement.

AEROFIN *is sold only by Manufacturers of Nationally Advertised Fan System Apparatus.*

List upon Request

AEROFIN CORPORATION

850 Frelinghuysen Avenue, NEWARK, N. J.

Burnham Bldg. CHICAGO

Land Title Bldg. PHILADELPHIA

11 West 42nd Street, NEW YORK

United Artists Building DETROIT

Oliver Bldg. PITTSBURGH

Paul Brown Bldg. ST. LOUIS

MARSH RE-ENFORCED PACKLESS, CONE DISC LINE, complete in ALL PATTERNS and SIZES; *Angles, Globes, Corner* and *Back Offsets,* both PACKLESS and MODULATED types.

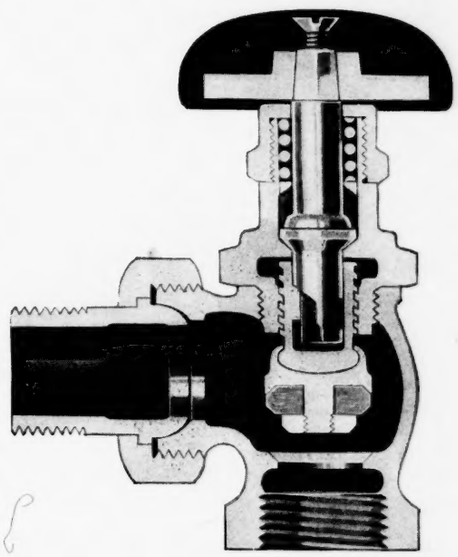


Fig. 141—Sectional View

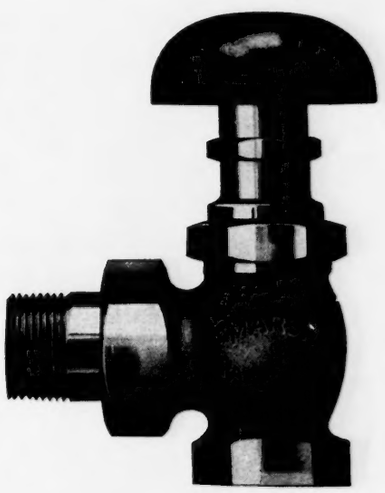


Fig. 141

In addition to the above CONE DISC LINE, our FLAT DISC LINE is ALSO COMPLETE IN ALL PATTERNS and SIZES, BOTH PACKLESS and MODULATED.

FURTHER: We furnish complete line of GLAND PACKED, rising stem valves, *Angles, Globes, Corner* and *Back Offsets,* all sizes, BOTH in CONE and FLAT DISC Patterns. Also, *quick opening* and *upper seat* GATE Valves, *both with screwed ends* and *with unions, all sizes.* Line complete. Get our Catalog and Discount Sheet.

WE SPECIALIZE on HIGH GRADE radiator valves, THEREFORE QUALITY; and manufacture and furnish the largest and most complete line of any company in the world, THEREFORE QUANTITY at minimum cost; and—QUALITY and COST—are two important factors to consider in placing orders.

EVERY VALVE IS FULLY GUARANTEED

MARSH VALVE COMPANY

DUNKIRK **NEW YORK**

General Sale Distributors

Edward T. Hetherington
1709 Sansom St., Philadelphia

Appleton & Liptrott, Inc.
1480 Broadway, New York

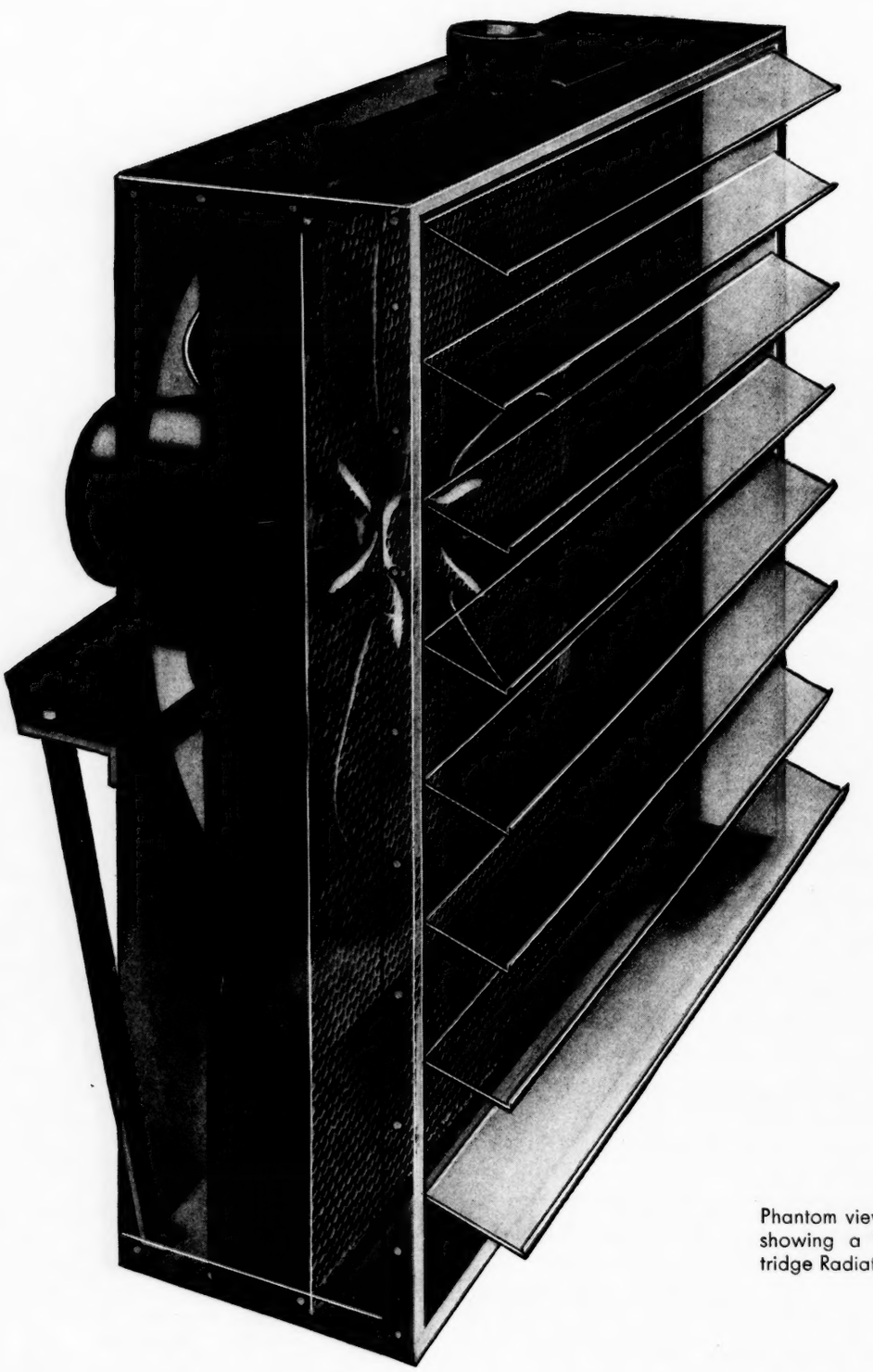
John W. Mabbs
431 So. Dearborn St., Chicago, Ill.

UNITED STATES RADIATOR CORP'N
General Offices: Detroit, Mich.

SARCO COMPANY, Inc.
183 Madison Ave., New York

Taylor-Forbes Company
Canadian Agents Guelph, Ont.

The Ultimate



Phantom view of a unit heater showing a Winchester Cartridge Radiator Core in place.

Radiator Core

WHEN selecting unit heaters, experienced engineers insist upon equipment whose covering power is not limited by the inherent shortcomings of radiating surfaces. Even with a highly effective fan design, if the radiator seriously impedes the air blast, the "reach" of the unit heater is shortened and its effectiveness impaired.

The outstanding requirement is for a radiating surface that does not impede the blast delivered by the fan. This important feature is the foundation of Winchester radiator design. Because of its superiority in this respect it is the ultimate radiation.

Mechanically, the refinements in design and manufacture which have been incorporated in Winchester radiators make them the most completely reliable of low pressure cores.

In performance, the great covering power of unit heaters equipped with Winchester cores makes them far more economical to install and to operate. Because they can be located high in the air and close to ceilings, the fuel savings effected are enormous.

To obtain Winchester radiation when buying unit heaters, it is necessary only to specify "to be equipped with genuine Winchester Cartridge Core radiation" on the order.

Ask us for complete information and proof of operating efficiency.

WINCHESTER
TRADE MARK

COPPER RADIATORS

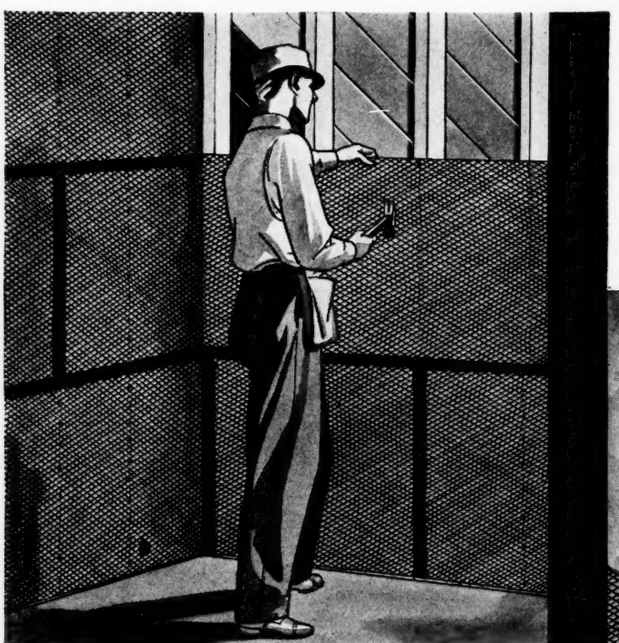
RADIATOR SALES DIVISION
WINCHESTER REPEATING ARMS CO., NEW HAVEN, CONN., U. S. A.

THE INSULATION THAT MADE GOOD OVERNIGHT

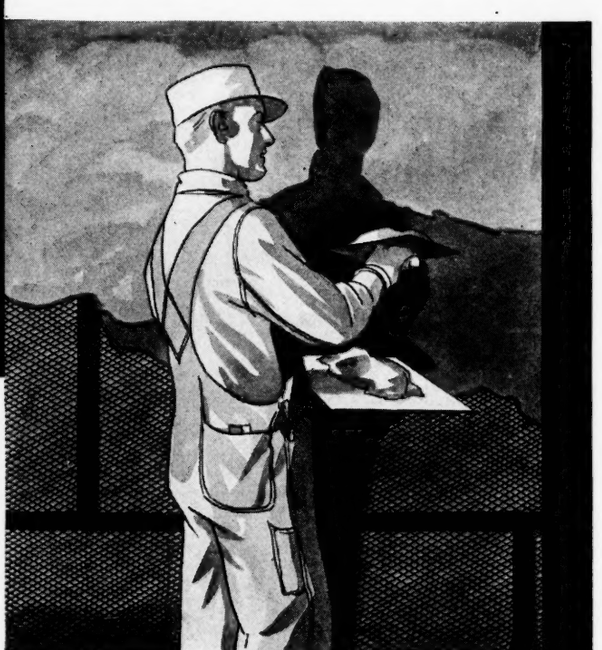
BI-FLAX

A PLASTER BASE OF STEEL

WITH FLAX-LI-NUM INSULATION



INSULATES AGAINST HEAT AND COLD

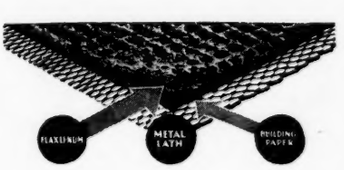


PROTECTS AGAINST PLASTER CRACKS

Flax-li-num has long been recognized as the highest type of insulation available . . Diamond mesh metal lath painted with asphaltum after forming, is universally accepted as the ideal plaster base.

While Bi-Flax is a new development in building materials . . it is new only because, for the first time, it combines these two long-accepted materials into a practical insulating plaster base.

Since its announcement a few months ago Bi-Flax has become the most discussed insulation on the market. It revolutionizes plastering and insulating practice. It protects buildings of all kinds against age as well as weather. It offers a perfect plastering surface without loss of insulating value. Ask for a sample of this remarkable new material.



Product of

THE FLAX-LI-NUM INSULATING CO.

ST. PAUL, MINNESOTA

The Heating and Ventilating Industry Is Invited to Attend

The 12*th* ANNUAL EXHIBITION *of the* AMERICAN GAS ASSOCIATION

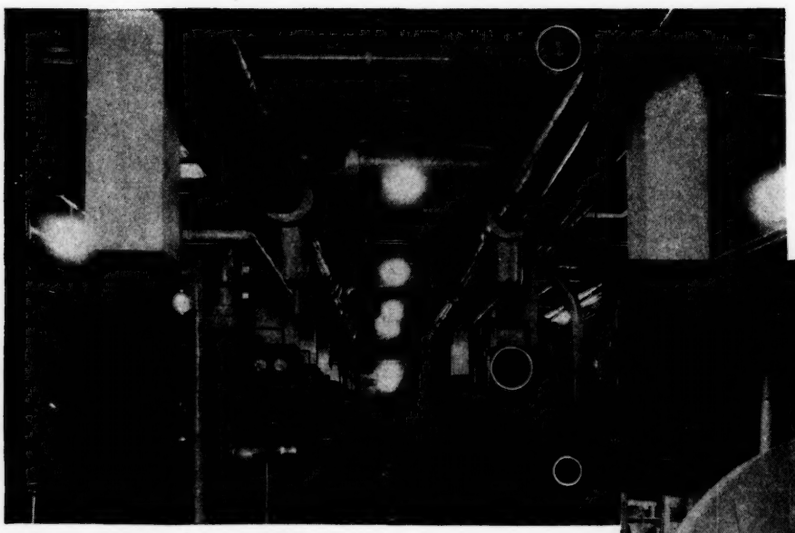
More than 50 manufacturers of Heating and Ventilating Apparatus and Appliances are displaying at this Convention

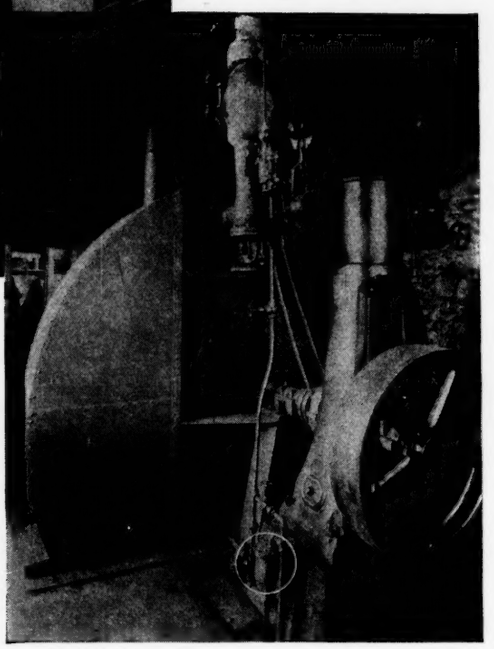
which will be held in conjunction with the next Convention at

ATLANTIC CITY
October 13-16, 1930

Admission Passes May be Secured by Applying to

C. W. BERGHORN
Director of Exhibits
Main Floor
Municipal Auditorium
Atlantic City, N. J.





At left: Armstrong Special and No. 2 traps in Royal York Hotel, Toronto, Ont. The special type takes care of pulsating loads. Below: Armstrong Trap protecting a steam engine driving a blower

A *foolproof* steam trap for heating equipment

SINCE their operation is practically foolproof, Armstrong inverted bucket steam traps enable you to guarantee perfect condensate drainage of unit heaters, mains, engines, and other heating and conditioning accessories at all times. It is not unusual for Armstrongs to work years with no attention whatsoever.

These traps are small in size, with large capacity. They cannot airbind. Scum and sediment are discharged with condensate; the action makes them self-scrubbing. The radiation loss is small and they do not leak steam or wiredraw.

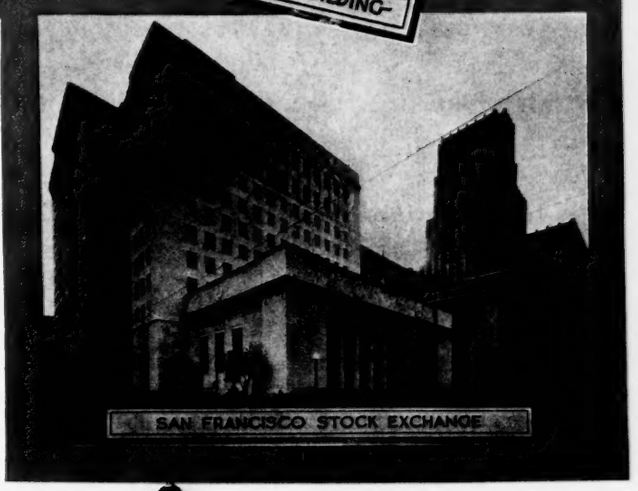
We are glad to co-operate with engineers and architects in determining the proper sizes of traps on heating jobs, without obligation. Detailed data on traps and applications sent on request.

Armstrong Traps are furnished in sizes and types for pressures to 1350lbs. and any degree superheat

H&V 10—Gray

ARMSTRONG MACHINE WORKS
Three Rivers, Michigan
District Representatives in 42 Cities

AMERICAN-MARSH in San Francisco



FOR heating, for hot and cold water circulating, fire protection, boiler feed, etc., in San Francisco, as in other cities throughout the country, a high percentage of the finer buildings rely on American-Marsh Pumps. The new Stock Exchange, new Doctors' and Dentists' Building, new Temple Methodist Church and William Taylor Hotel are typical of the many American-Marsh installations in this western metropolis.

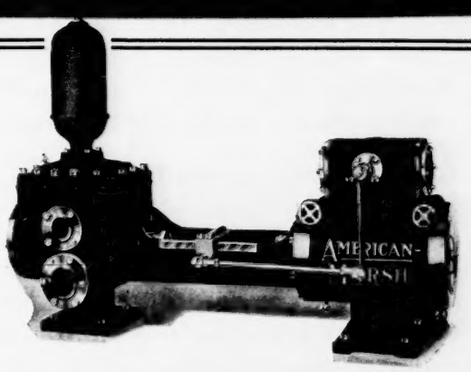
Good reasons lie behind the decided preference for American-Marsh. The design, modern and inherently sound, insures maximum economy. The construction, rugged beyond customary standards, guarantees unfailing performance despite the severity of operating conditions.

We make both centrifugal and steam pumps—in all approved types—in all practical sizes. Our engineering service and our technical bulletins are yours for the asking. It pays to consult American-Marsh *first.*

AMERICAN STEAM PUMP CO.

BATTLE CREEK, MICHIGAN

SALES ENGINEERING OFFICES IN PRINCIPAL CITIES



SIMPLEX STEAM PUMPS

THIS company has built simplex steam pumps for almost half a century. To-day we produce more than 20% of them because American-Marsh Simplex Steam Pumps embody economy features found nowhere else, and because they outperform and outlast ordinary equipment by a wide margin. Ask any operating engineer.

11½¢ Per Square Foot of Radiation with Gas

Public Service Company of Oklahoma Building at Tulsa, Oklahoma

Heated by the Gas-Fired Heggie-Simplex Steel Heating Boilers shown below.

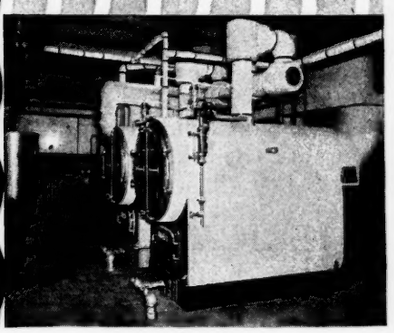
The 1929-30 heating season in Tulsa, Oklahoma, was one of the longest and coldest winters in the memory of the oldest inhabitants. Although the temperature was down to 17° below zero and the heating season ran over seven months, gas-fired Heggie-Simplex Boilers supplied heat and hot water for the Public Service Building there at a total cost for the entire season of only 11½c per square foot of radiation.

In all territories where gas is a popular fuel, Heggie-Simplex Steel Heating Boilers are found in large numbers.

Distinctive features make these modern heating boilers highly adaptable to the efficient use of gas. An extra large amount of heating surface, in direct contact with the fire and with its radiant heat, assures maximum utilization of all heat units as rapidly as they are released. Tubular flues, which carry the burned gases twice the length of the boiler, strip them of all usable heat before they reach the chimney. Freely circulating water carries the heat to the outlets rapidly and without waste—the water is all in one body and is free from restricted passages.

Of electrically welded steel construction, Heggie-Simplex Boilers provide the crack-proof, leak-proof protection that is so important in automatic firing. Their upkeep, like their cost of operation, is minimum. And should it ever be desired, they readily can be converted to use with *any* other fuel—*Heggie-Simplex Boiler Co., Joliet, Illinois—Representatives in Principal Cities.*

MEMBER OF THE STEEL HEATING BOILER INSTITUTE



HEGGIE-SIMPLEX

STEEL HEATING BOILERS

HEATING AND VENTILATING

REG. U. S. PAT. OFF.

formerly

The Heating and Ventilating Magazine

Contents of previous issues of HEATING AND VENTILATING *can be found by consulting the Industrial Arts Index at the nearest library.*

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VOL. 27 **No. 10**

The Line of Progress

"HEAT Your Home With Gas—Ask Us About It," reads a sign I noticed, not in the window of a gas utility, but on the door of a heating contractor's car. Similar signs in the interest of oil heat and automatic coal heat are becoming commonplace. These men have caught the spirit of the times and are progressing with the industry, rather than allowing outgrown precedents to guide their business activities. They are blazing the way toward the new type of heating contractor who is thinking primarily in terms of Automatic Heat, whether oil, gas or coal.

More strength to them!

A. S. Armagnac

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Each a treatise on a particular class of building

December 1930 Issue — Industrial Buildings

Later Reference Numbers will include—

Transportation Buildings Department & Other Stores Public Buildings & Institutions

Theatres Churches Hospitals Hotel and Apartment Buildings Office Buildings

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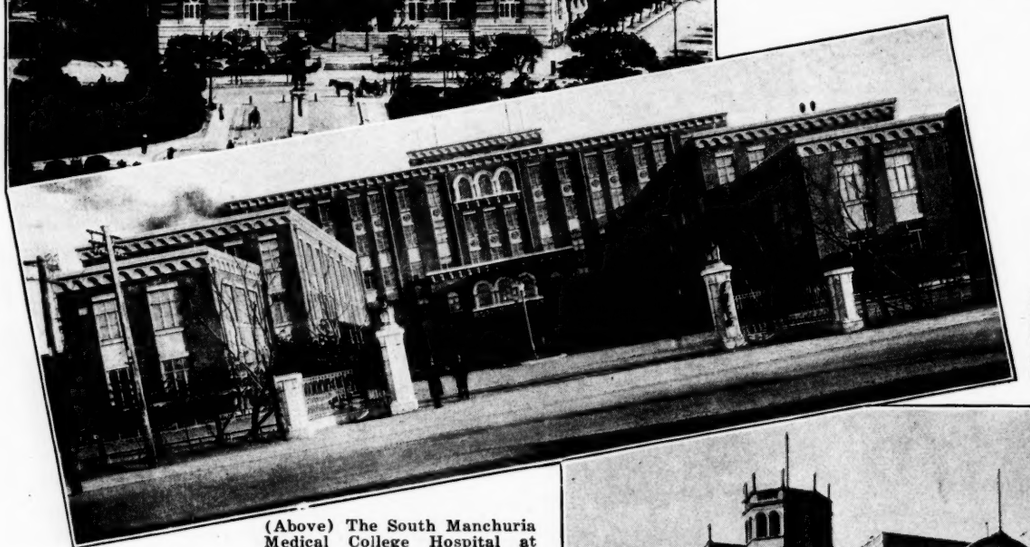
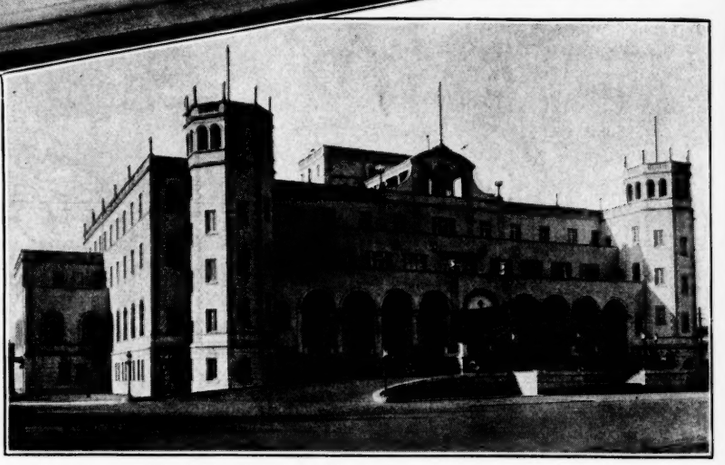
(Left) Dairen Yamato Hotel furnished with Sarco Type H Radiator Traps by Nishikawa & Co., Dairen, in 1927.



(Below) Mukden Yamato Hotel furnished with Sarco Type H Radiator Traps, Boilers and Radiators, by Nishikawa & Co., Dairen, in 1928.

(Above) The South Manchuria Medical College Hospital at Mukden, furnished with Sarco Type H Radiator Traps and Classic Radiators, by Nishikawa & Co., Dairen, in 1928.



How Western Skill Helps Eastern Progress in MANCHURIA

BORE down far enough at Reno, Nevada, and you will come out the other side of the globe at Dairen, Manchuria, about 30 miles northeast of Port Arthur; head of the South Manchuria Railroad, and virtually the property of the railway company. Here the system has built a magnificent modern city, erecting hotels which, for the Orient, are sumptuous.

At Mukden, capital of Manchuria, about 225 miles northeast of Dairen, and the other terminus of this branch, the railroad has put up a hotel probably not excelled in furnishing and equipment anywhere in the Far East.

That Sarco Traps were selected by the Japanese engineers for the three important installations pictured above is notable. One does not transport equipment half way 'round the world unless one is *sure it is right.* Write for Catalog P-80, giving complete information.

SARCO RADIATOR TRAP BUILT TO A QUALITY STANDARD

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SARCO

RADIATOR TRAPS

Sarco Thermostatic Radiator Trap Type H installed in buildings shown above.

Editorial

The Biddle Plan

EVER since the Biddle Plan for maintaining credits in the building industry was presented at the 1929 convention of the Heating and Piping Contractors National Association, heating men have been looking for a chance to apply the principles of the plan in their respective localities. This was easier said than done, because the plan involves close coordination on the part of all branches of the building industry. Stated briefly, the groups operating under the Biddle Plan act as a police force to see that the suppliers or the sellers live up to their obligations. When they do not, the groups, acting as a unit, inform the entire membership that such seller has violated the credit terms of his industry.

In New York, the heating industry is ready to function in this important matter through the recently-organized New York Heating Board of Trade. As a starter towards a more comprehensive movement, the time seems ripe for the organization to include credit control as one of its major activities. If it does, it will have the sympathetic interest of the entire heating and ventilating industry and will merit the distinction of having taken the lead in meeting a condition which is sorely in need of adequate attention.

More Cooperation and Less Antagonism

WITH the steady growth of gas house-heating, the subject of cooperation between the gas utilities and heating contractors is assuming larger proportions. At the last convention of the American Gas Association in 1929, the sentiment was expressed by more than one speaker that the contractors and gas companies should work more closely together. At the same meeting, in no less enthusiastic terms, a representative of a middle western utility expressed the feelings of many association members when he stated that the heating contractor never was and never will be a merchandiser, and that the gas company is wise to handle the sale of gas-fired heating equipment entirely through its own channels.

It may as well be admitted that the utilities are in a better position to do without the heating contractors than the contractors are able to do without the gas companies. It will do little good and possibly great harm if the contractors approach the subject on the premise that the gas companies are operating unfairly when they handle their own merchandising problems.

As pointed out by George A. G. Wood, president of the Washington Gas Light Company, at a meeting of the Washington (D. C.) Master Plumbers Association, both the gas company and the contractor are working to the same end,—selling service to the public. So that he can be of greater service to the public, and in the end profit financially by the arrangement, the heating contractor might well impress the utility with the fact that he is an important factor in the sale of heating equipment. He should show the utility, for instance, that he is in a position to be of great assistance in the installation of gas boilers, repairing the heating system and taking care of numerous troubles which may operate to the disadvantage of the gas installation.

The problem calls for more cooperation and less antagonism.

Oil and the Gas Market

INROADS of gas as a house-heating fuel, particularly in localities reached by natural gas lines, have crystallized plans for a daring counter move on the part of the oil-burner industry. The proposal is that the oil-burner manufacturers take a leaf from the experience of the coal industry which first bucked and then adopted oil fuel. Instead of bucking gas, oil-burner manufacturers are considering the addition of conversion burners and even gas-fired boilers to their line of products. The point is made that, after all, the oil-burner industry is marketing automatic heat and, so long as there exists, in some quarters, a preference for gas, the oil-burner manufacturer should be in a position to meet such a demand.

But when it comes to the dealer, that is another matter. Manufacturers may well feel the urge to widen their field to meet consumer demands, but the dealer will do well to stick to his last. He is facing a condition, not a theory, in the gas appliance market, in which the advantage is all with the gas companies.

Heating and Ventilating the Empire State Building*

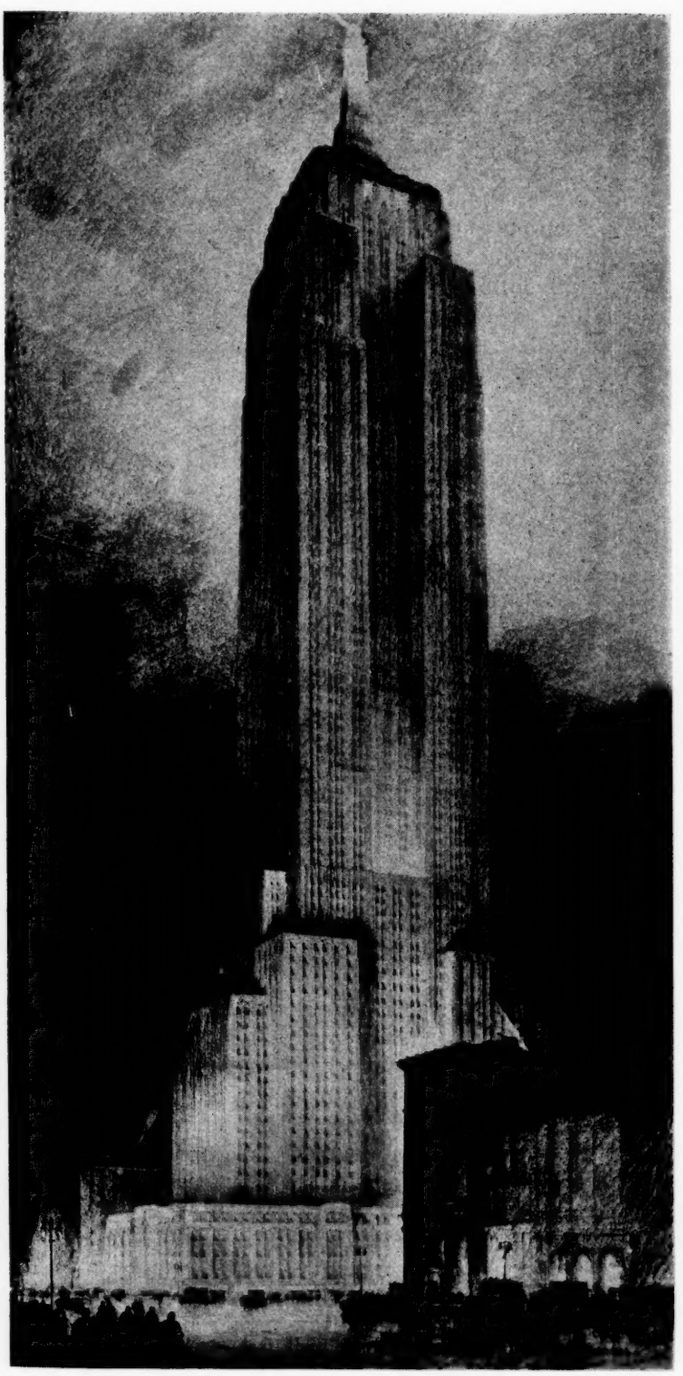
by **HENRY C. MEYER, Jr.**

Meyer, Strong & Jones, Inc., Consulting Engineers, New York

IT is perhaps to be expected that the heating and ventilation of a structure as large as the Empire State Building would introduce new problems that require some thought and ingenuity to solve, especially in the matter of ventilation of the lower stories, which cover an area of something like 425 ft. by 200 ft., embodying large spaces that are sufficiently remote from windows to require artificial ventilation for their successful occupancy. The running of steam piping for a building 86 stories in height also presented a problem. In addition to the 86 stories there will be the observation tower rising 200 ft. higher than the main structure. Two observation galleries at the base of the tower and one at the top are to be heated.

It has been the experience of the writer that it is practically impossible, especially in the hot, sticky days of summer and the severe days in winter when the windows have to be closed, for office workers to work efficiently in unventilated interior spaces remote from windows. Artificial ventilation is not perhaps necessary in large loft spaces, even if a good deal of it is remote from windows, if the space is to be used as a sales room for the display of merchandise and the number of people there is small. But where these spaces are used for office purposes, fairly densely occupied, and where the occupants are under a mental strain, the writer is convinced that artificial ventilation is of great importance.

The financial side of ventilating spaces in office buildings used for commercial purposes should be a matter of some interest. It was found in the case of a prominent bank building located in the financial district in New York that the cost



Architects, Shreve, Lamb & Harmon *Engineers, Meyer, Strong & Jones, Inc.*

The New Empire State Building, Fifth Ave., 33rd and 34th Sts., New York

*Reprinted from *The Architectural Forum* for October, 1930.

of artificially ventilating 75 sq. ft. of space, which was the amount of space allotted to each occupant, amounted to about $20 per year. This charge covered the cost of current to drive the fans, the cost of steam required to warm the air for ventilation, the fixed charges on the ventilating plant, the fixed charges on the cost of the increased story height required by the horizontal ventilating ducts and the value of the space occupied by the fan room, all being pro-rated to the 75 sq. ft. of rentable area.

If the average compensation to the worker was $1,000 a year in salary, it meant an increased cost of 2% to maintain proper working conditions. It is believed that a good deal more than 2% more work could be accomplished by the occupant if surrounded by good air conditions than would be possible with conditions that would exist in such a space without ventilation.

Expressed in another way, if the 75 sq. ft. of the space is rented for $2.50 per ft. or a total of $187.50 per year, the cost of ventilating at $20 would be about 11% of the rental. While this may seem quite a burden, it is not very much if artificial ventilation converts undesirable area into space that can be used with comfort and satisfaction on the part of the occupants. For these reasons one should feel gratified that the owners of the Empire State Building were far-sighted enough to be willing to go to the expense of ventilating the lower stories of the building, where the areas are large.

Reference has been made to the necessity of ventilating the two basements and the five lower stories of the building. A study of this problem was made with the idea always in mind that there was no telling to what use these spaces might be devoted during the life of the building, and it was felt that unless a flexible system of ventilating could be designed to meet any reasonable situation that might arise, the system would be a failure at the start.

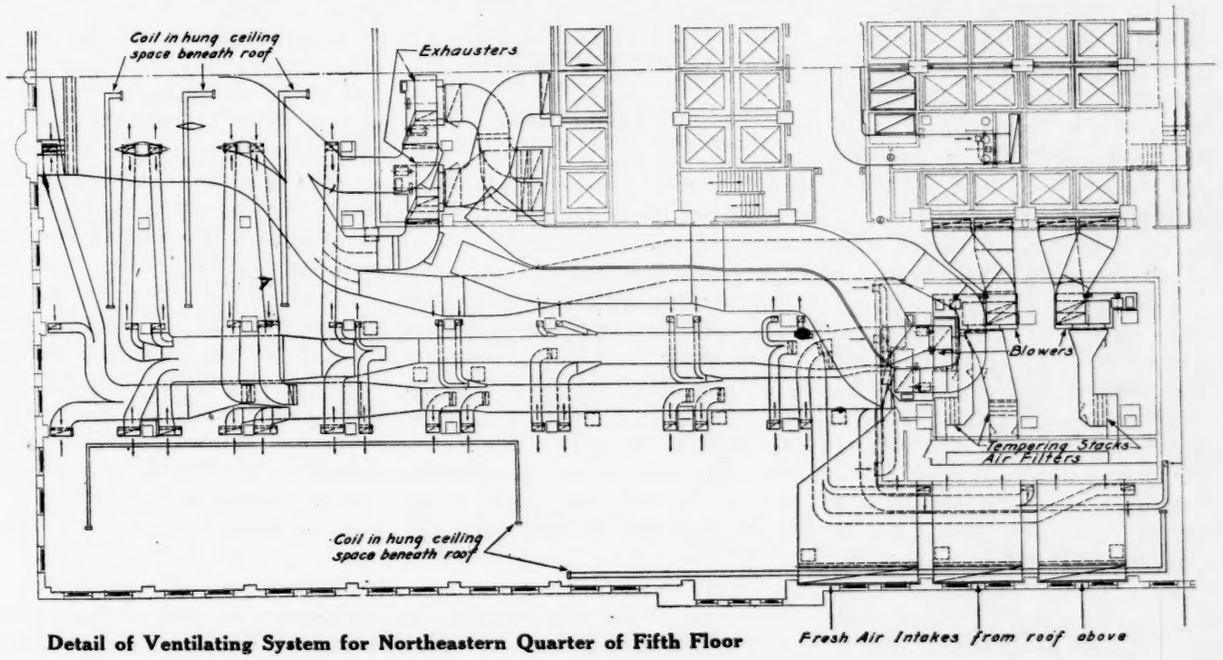
Arrangements were therefore made to take what was believed to be a sufficient volume of air into the building at the southwest corner on the second floor. A vertical shaft connecting with the air intake extends to the floor of the lower basement and there connects with a large underground supply duct which extends entirely around the space devoted to elevators, stair wells, etc. With such an arrangement, it is possible to locate supply fans at many points in the basement so as to meet the needs of the situations that might from time to time arise.

The scheme for the use of an underground supply duct was selected for the reason that it required excavation for the dimensions of the duct only rather than throughout the whole sub-basement, which would be necessary if the duct were placed at the ceiling with normal floor clearance below, as is often done. Inasmuch as all sub-basement excavation had to be made through rock, this scheme of the underground duct made possible a tremendous saving in time and expenditure in excavation.

Large exhaust shafts of ample size to take care of kitchens extend from the basement to the top of the building, with space for fan rooms at the top for such exhaust fans as may be required. The exhaust from other sections of the basement is taken care of by exhaust shafts extending to the fifth floor, where the discharge is arranged for through the roof over the first setback.

For the ventilation of the first to the fifth floors, inclusive, there are four large supply fan rooms on the fifth floor, each taking care of a quarter of the building. A drawing of the northeast corner of the fifth floor is given. Air for this part of the building, and in fact for all quarters, is taken in through an intake on the roof over the fifth floor where a setback occurs. It extends downward through the roof to large, flat horizontal ducts extending horizontally to the filter chambers. The horizontal ducts are of copper properly drained and covered with non-conducting material. In each of the fan rooms there are three blowers, one supplying air to the first and second floors, another to the third and fourth floors and the third to the fifth floor.

They supply air downward through



Detail of Ventilating System for Northeastern Quarter of Fifth Floor

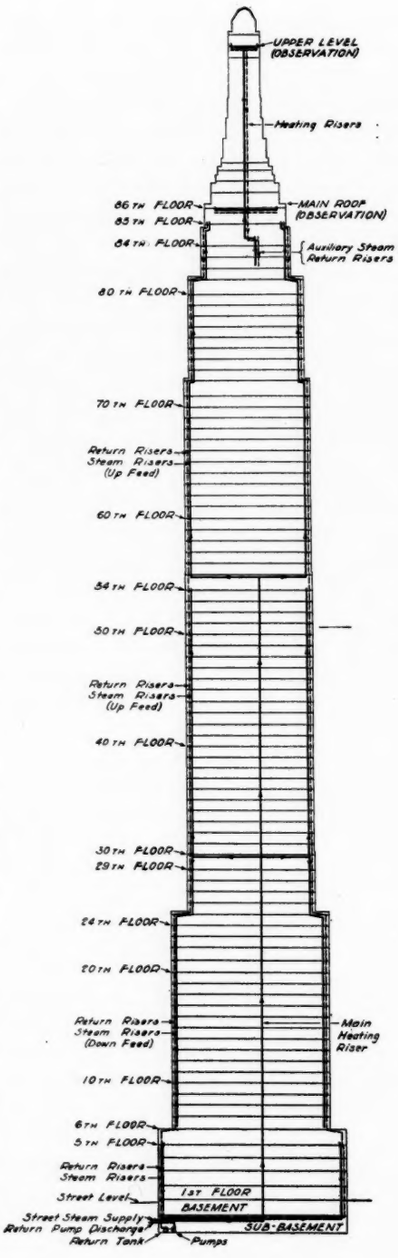
vertical shafts connecting with horizontal trunk ducts on each floor which are located over the corridors and extend around the utility space. Similar trunk exhaust ducts extending around each floor in similar manner connect with vertical shafts at the end of the utility spaces and on the ceiling of the fifth floor, transfer horizontally to exhaust fan rooms, the exhausters discharging out through the roof over the fifth floor and as close to the extreme east and west ends of the building as possible. The extensive setback which occurs at the sixth floor level seemed to make it possible to discharge fans in this manner without objection by the tenants on the floors above and obviated the necessity of providing shafts to the roof for the discharge of this air.

It is intended to extend branch ducts from the supply and exhaust trunks in such a manner that each separate bay of the building, except those along the outer walls, will be provided with supply and exhaust registers. These are located at the columns in such a manner that if partitions are confined to column center lines, each interior bay will have its independent supply and exhaust.

Provision has been made in the vertical shafts for the installation of clubs, with their necessary kitchens and dining rooms, on the sixth and twenty-first floors; it is intended to locate a supply fan on each of the club floors with the necessary horizontal distributing ducts. The main shaft extending to the roof and intended to ventilate kitchens is believed to be of ample size to take care of the needs of any kitchen required by the club.

Since all toilets are interior rooms, there are four toilet exhausters located on the 85th floor, each fan having a capacity of 40,000 c.f.m.

There are seven blowers and seven exhausters located in various parts of the building for ventilating the elevator machinery rooms, with a total capacity of about 75,000 c.f.m. supply and exhaust. It may be of interest to note that approximately 400 sq. ft. had to be allowed for in the utility space of the upper floors for vent shafts to accommodate the toilet exhaust flues, the basement kitchen exhaust flue, and the several other exhaust flues from kitchens and restaurants in the upper stories of the building.



Heating System Zoning

All the air supplied to the building is filtered through dry air-mat type filters consisting of sheets of porous paper, which provide a filtering medium of high efficiency at the same time offering only a surprisingly slight resistance to the air flow.

All fan motors are of the variable speed type so that the volume of the air supplied and exhausted on the various systems can be regulated to suit conditions.

Some idea of the magnitude of the equipment can be had when it is said that the building will contain about 7,000 radiators with a total of 227,000 sq. ft. of heating surface. It is not known at this time how much air will be required for the basements, but the total supply for the first to the fifth floors, inclusive, would be about 292,000 cu. ft. per min. with an exhaust of the same amount.

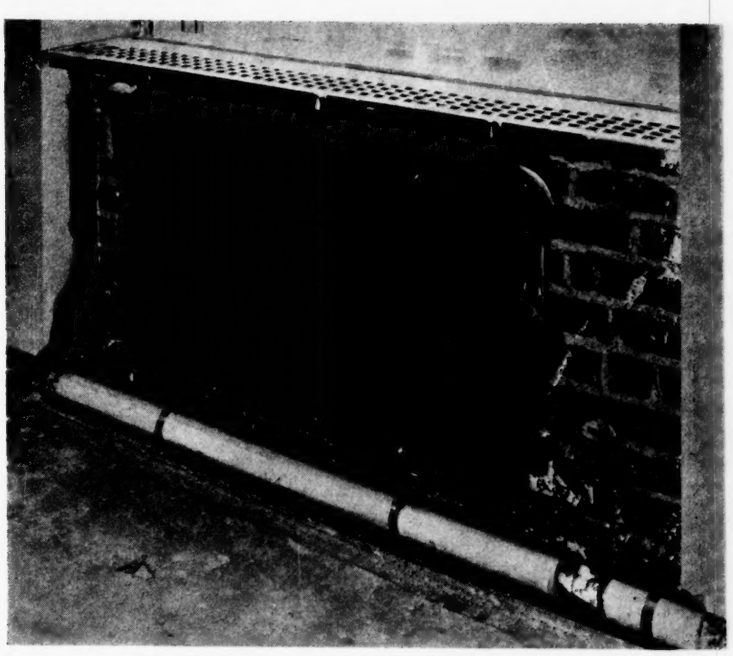
The study made during the early stages of the preparation of plans led the owners to contract for an outside supply of steam. When it was found that a chimney of proper size for the building, with its surrounding ventilating space for the boiler room and enclosing masonry, occupied an area of about 350 sq. ft. on all floors of the building, and a proper charge was made for the value of the space so used, a boiler plant within the building did not seem to be justifiable. It was possible to supply the building through two entirely independent steam mains, entering on 33rd Street, both connected with the distributing mains of the local steam company. This seemed to afford ample protection against serious breakdown.

The heating of the building will be accomplished by a two-pipe vacuum system with steam-turbine driven vacuum-pumps discharging through suitable heat exchangers into the sewer. On account of the very great height of the building, some 86 stories, with the observation tower 200 ft. high in addition, it was manifestly impossible to employ one set of risers supplying radiators on all floors on account of the size of pipes that would be required. The heating equipment was therefore divided into four separate zones, the lower zone up to and including the fifth floor being supplied from mains in the sub-basement; the section from the sixth to the 29th floors, inclusive, being supplied downward from a set of mains on the 29th floor ceiling; the section from the 30th to the 54th floors being supplied upward from mains on the ceiling of the 29th floor; and the top of the building, including the observation tower, from a set of mains on the 54th floor ceiling. Additional floor heights were provided on the 29th and 54th floors so that the mains could be run without interfering with proper ceiling heights. Considerable setbacks of

the building occur at the sixth and 30th stories.

Some idea of the extent of the equipment required for the heating may be had from the size of the low pressure steam supply riser, which is 24 in. in diameter up to the 29th floor; from that level up it decreases in size proportionately. This riser by itself weighs well over 100 lb. for each foot of its height, and its expansion joints weigh two tons each.

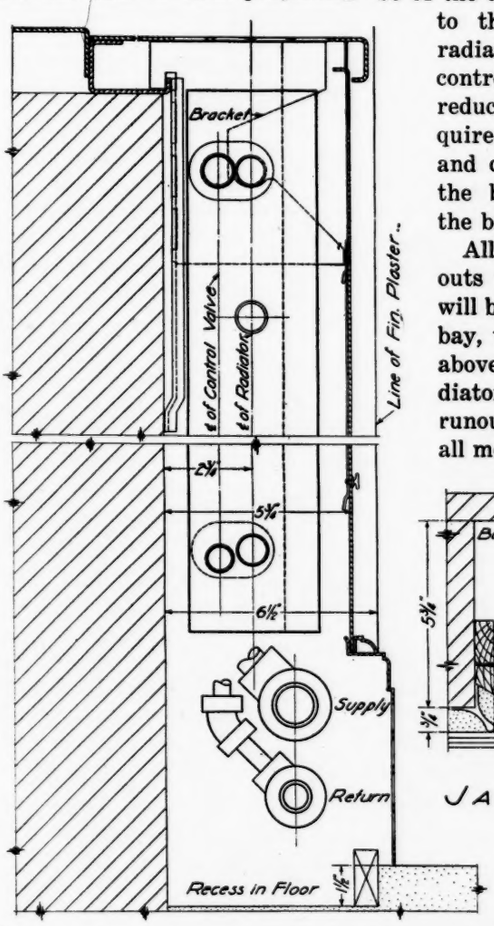
An interesting feature of the heating of the structure is the fact that practically every radiator in the building is concealed by a removal enclosure of sheet metal with the bottom grille at the floor and a top grille at the sill level. The use of radiator enclosures with a minimum of encroachment on the rentable space was made possible by the remarkably clever design of the exterior walls by the architects, Messrs. Shreve, Lamb & Harmon. The windows are practically flush with the outer face of the building walls, thus giving space beneath the windows for the radiators and enclosures without the need of their projecting out into the rooms beyond the wall line.



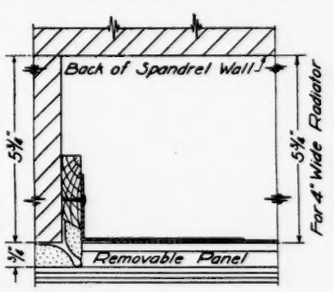
Typical Radiator Installation Flush with Wall

Detailed drawings of the radiator enclosures are shown. Radiators will be of the copper tube type bracketed to the walls. Practically all radiators are under automatic control, this not only tending to reduce the cost of steam required but to maintain proper and constant temperatures for the benefit of the tenants of the building.

All risers and radiator runouts will be concealed. There will be a pair of risers for each bay, with the runouts installed above the floor within the radiator enclosure. The return runouts to radiators, as well as all medium pressure system return piping except risers, will be of brass. Expansion in risers is to be allowed for by the use of expansion joints, loops and riser offsets.



Section Through Radiator Enclosure



JAMB SECTION

A separate system of steam mains is provided for medium pressure steam required by such kitchens as may be located within the building and for supplying hot water. A separate main is also provided for the steam required to warm the air for ventilating purposes. These two systems and that supplying the steam for direct radiators are separately metered, so that information as to the amount of steam required for the various services can be obtained.

There will be four turbine-driven vacuum pumps which will receive the condensate from both the low and medium-pressure system returns and drips during the winter season. The pumps will be so connected that any one or more pumps can handle the entire load, the number of pumps operating being governed by the load. For summer service there will be a single electrically-driven unit to handle the condensate from the medium pressure kitchen and hot water generator system.

Returns and drips on the kitchen apparatus and hot water generators will be controlled by thermostatic type valves and traps discharging into a vented trap, which in turn will discharge into the receiving

(Continued on page 97)

Electric Motors for Pumps

by **J. F. LAMB**

General Engineering Department, Westinghouse Electric & Mfg. Company

ELECTRIC power-driven pumps are used in buildings for a wide variety of applications such as house water supply systems, fire pumps, brine circulation, vacuum pumps, sewage ejectors, sump pumps, and in connection with air conditioning apparatus.

Pumps can be considered as belonging to one of two general classes, centrifugal pumps and positive displacement pumps. Centrifugal pumps are used for the vast majority of applications found in buildings.

When the speed of a centrifugal pump is changed, the following relations hold:

1. The quantity of water delivered will vary directly with the speed.
2. The head will vary as the square of the speed.
3. The power required will vary as the cube of the speed.

At a constant operating speed the quantity of water delivered will increase when the head is decreased. The brake horsepower required will increase from the "shut off" or no delivery value to some maximum value, and then decrease to the "wide open" or free delivery value. Fig. 1. shows the head and brake horsepower curves for a centrifugal pump of commercial design, indicating this power limiting characteristic.

A centrifugal pump requires a small starting torque. Only the low inertia of the impeller and the friction of the bearings need be overcome at the instant of starting. During the starting period, the torque required from the motor builds up as the speed increases until it equals full load torque at full load speed.

As centrifugal pumps operate very efficiently at high speeds, they are best driven by direct-connected electric motors; usually at 1750 R.P.M. where direct current or 60 cycle alternating current power is available.

A positive displacement pump whether of the plunger type or rotary type, will have different characteristics than a centrifugal pump. Neglecting slip, the following relations will hold if the speed is changed:

1. The quantity of water delivered will vary directly as the speed.
2. The head will be essentially the same.
3. The brake horsepower will vary directly as the speed.

At constant speed, increase in head does not affect the amount of water delivered by a positive displacement pump, but does increase the brake horsepower in almost direct proportion.

A displacement pump of the reciprocating type will require different amounts of torque in the different positions of the crankshaft. The motor in order to supply this torque will take a fluctuating current from the line. The magnitude of the current fluctuation will depend upon the number of cylinders, moment of inertia of the rotating parts, and various other factors.

A positive displacement pump may require considerable starting torque as not only must pump inertia and friction be overcome, but the pump also must be started against the inertia and the normal opposing head of the water column. A motor and control application for a positive displacement pump must therefore make some provision for obtaining considerable starting torque unless some mechanical means for unloading or by-passing the pump is provided.

Positive displacement pumps can best be driven through belts, chains, or gears on account of their comparatively slow speeds.

Most buildings have available 230 volts direct current or else polyphase alternating current power so that the following types of motors can be considered for pump drives.

A. Polyphase alternating current motors.
   1. Squirrel cage induction motors.
   2. Wound rotor induction motor.
   3. Synchronous motors.
B. Direct current motors.
   1. Shunt wound direct current motors.
   2. Compound wound direct current motors.

Squirrel cage motors are used for the bulk of pump applications in buildings having alternating current power on account of their low cost, low maintenance, ruggedness, reli-

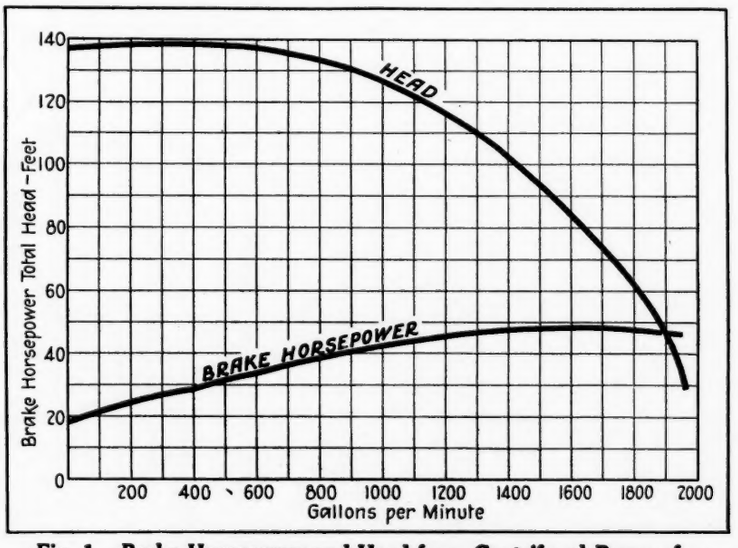


Fig. 1. Brake Horsepower and Head for a Centrifugal Pump of a Commercial Design

ability, and simplicity of control. Where the power company is willing, and where the power circuits are arranged so that there will be no difficulty from flickering of the lights, squirrel cage motors driving pumps may be started by throwing them across the line.

Certain starting current limits for electric motors have been recommended by the National Electric Light Association in order to reduce the line disturbances to a minimum when connecting the motors to the supply line. Fig. 2 shows the values of starting currents recommended by the N.E.L.A. for different sizes of three phase motors. Several classes of squirrel cage induction motors are available on the market with electrical characteristics depending upon the combinations of starting torque and starting current which are required for various applications.

1. Standard general purpose motors are designed to supply starting torques of 150% of full load torque for 2- and 4-pole motors, 135% of full load torque for 6-pole motors and lower values for other pole combinations when started at full voltage. Under these conditions, the starting currents are not guaranteed to fall within the N.E.L.A. recommendations, but may possibly be anywhere between five and ten times full load current.

2. Linestart general purpose motors will supply the same starting torques as standard general purpose motors and in sizes 30 H.P. and below, the starting currents at full voltage will fall within the values recommended by the N.E.L.A. Above 30 H.P., the full voltage starting currents are approximately 500 to 550% of full load current, so that reduced voltage auto transformer type starters with 80% voltage taps can be used if N.E.L.A. recommendations must be met.

3. Low torque linestart motors are available in sizes from 40 to 100 H.P. at 60 cycle speeds of 1160 or 1750 R.P.M. The starting torque may be 80 or 100% of full load torque. These motors are intended to be used for centrifugal pumps and other applications requiring low starting torques where it is desired to start the squirrel cage motors across the line and still fall within the N.E.L.A. recommendations for starting currents. It should be noted that this class of motors is intended to supplement the linestart general purpose motors in sizes above 30 H.P.

Any of the above three classes of squirrel cage motors are suitable for centrifugal pump drives and can be started either at full voltage or at reduced voltage. The type to use will depend upon local conditions such as regulations of the power company and arrangement of the supply circuits. The low torque linestart motors are slightly lower in cost than the linestart general purpose motors, but slightly higher in cost than the corresponding sizes of standard general purpose motors.

4. High starting torque linestart motors provide starting torques from 200% to 225% at full voltage, and, in sizes 30 H.P. and below, will take starting currents within the N.E.L.A. recommendations. Above 30 H.P. the full voltage starting currents are approximately 500 to 550% of full load currents. These motors are higher in cost than either of the other three classes on account of the "double deck" type rotor winding. They are desirable for use with positive displacement pumps starting under load where across the line starting is permissible.

Wound rotor induction motors are used on centrifugal pumps where control of the pump water delivery by speed reduction is desired, or where limitation of the initial starting current is necessary. A frequent application in buildings is for the drive of large fire pumps. They are also used on positive displacement pumps where large starting torques are required and it is not permissible to start squirrel cage motors across the line.

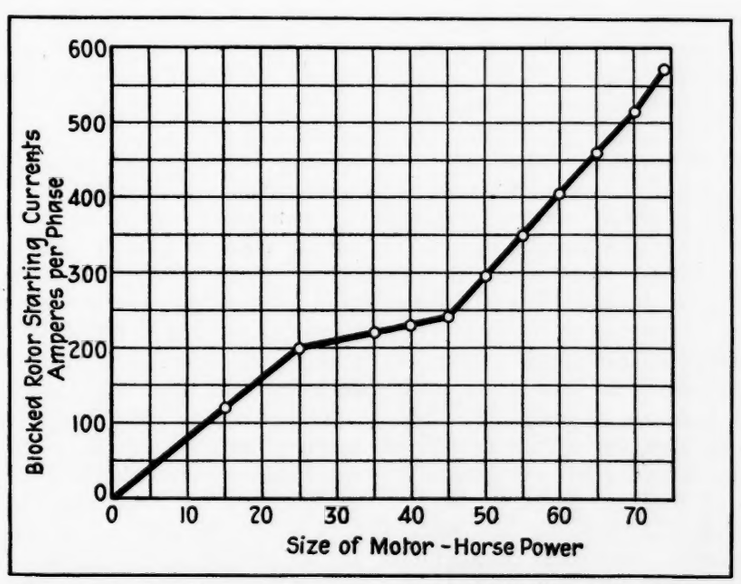


Fig. 2. Starting Currents Recommended by the N.E.L.A. for Different Sizes of 3-Phase, 220-Volt, 60-Cycle Motors

Synchronous Motors Rarely Used with Pumps in Buildings

Synchronous motors, on account of their favorable power factor, are desirable for driving constant speed, continuously operating pumps which require large horsepower capacities. They are popular for applications such as city water supply pumping stations, drainage and irrigation projects and mine pumps. As pumps used in buildings require comparatively low horsepower and usually operate intermittently, they are very rarely driven by synchronous motors in preference to induction motors.

Where direct current power is available, either shunt or compound wound motors can be used. In most cases, it is better to use shunt wound motors for centrifugal pumps on account of their slightly lower cost and better speed regulation as compared with compound wound motors. For reciprocating pumps, compound wound motors may be desirable because the current fluctuations due to the fluctuating torque of the load are somewhat smaller than for shunt motors.

A direct current motor driving a pump can easily be overloaded if its speed is increased above the rated value due to a weakened field. This is particularly true if the motor is

driving a centrifugal pump, because the power input to a centrifugal pump will vary as the cube of the speed, whereas the power input to a positive displacement pump will vary directly as the speed.

Motors are Rated on a 40° C. Temperature Rise

It is customary for manufacturers to base the continuous horsepower ratings of most of their standard designs of alternating current and direct current motors upon a 40° centigrade temperature rise. That is, the motor is designed to carry its rated load continuously under normal conditions with a temperature rise above the surrounding air not to exceed 40° centigrade (72° fahrenheit) as measured by thermometers placed on accessible portions of the core and windings immediately after shutdown. This heating of the motor is of course due to internal losses such as friction, windage, iron loss, and copper loss.

Electrical insulation generally used in standard designs of motors will tend to deteriorate rapidly at temperatures above 105° centigrade (221° fahrenheit), so that the maximum allowable hot spot temperature at any one point in the motor can be taken as 105° centigrade. It may not be possible actually to observe the hot spot temperature by thermometers placed on accessible portions of the motor, since the hottest portions of the core and windings are usually in the interior of the machine. Fifteen degrees centigrade is conventionally assumed to be the difference in temperature between the hottest point in the motor and the maximum temperatures which can actually be observed by thermometers placed on accessible portions of the machine immediately after shutdown. This means that 90° centigrade (194° fahrenheit) is the maximum temperature as observed by thermometers at which an electric motor should be permitted to operate.

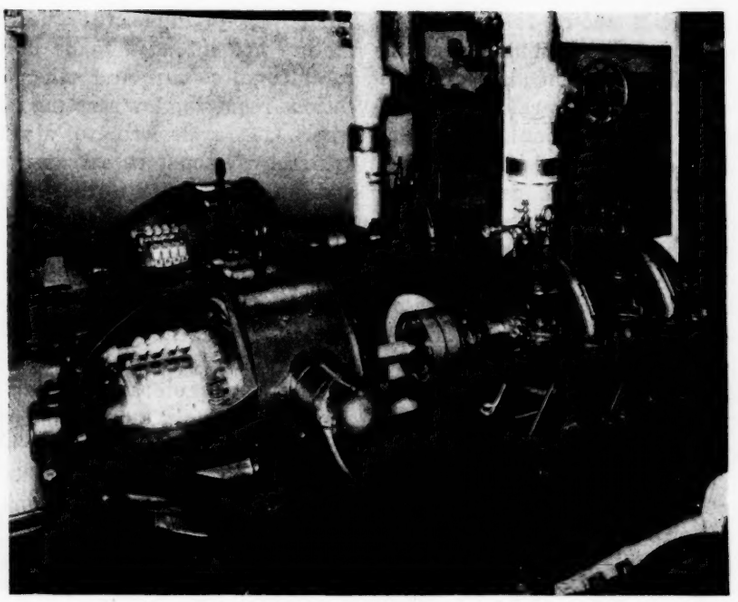
Forty degrees centigrade (104° fahrenheit) is considered to be the maximum permissible room temperature in which a standard motor should operate. At higher room temperatures, special motors are to be used. Most motors are used in room temperatures below 40° centigrade.

At a room temperature of 20° centigrade (68° fahrenheit), a 40° centigrade motor operating at full load under normal conditions will reach a final observable temperature of 60° centigrade (140° fahrenheit). If the room temperature is 40° centigrade (104° fahrenheit), the final observable temperature of the motor will be 80° centigrade (176° fahrenheit). This indicates that under normal operating conditions a fully loaded electric motor can be expected to feel quite warm to the touch. The fact that one's hand becomes uncomfortably warm when placed on portions of the motor does not necessarily indicate that the machine is overloaded.

It will be noted that there is a 10° centigrade difference in temperature between the upper limit of 90° centigrade and the 80° centigrade which a 40° centigrade motor may approach when the room temperature is 40° centigrade. This permits the application of various "service factors" to standard 40° centigrade motors. When used at rated voltage (and frequency in the case of A.C. motors) a standard 40° centigrade motor can operate successfully at 115% of its rated load continuously. The temperature rise under these conditions will normally be 50° centigrade instead of 40° centigrade.

Standard 40° centigrade motors will operate successfully at rated load and frequency with voltages not more than 10% above or below the nameplate rating. They will operate successfully at rated load and voltage on frequencies not more than 5% above or below the nameplate rating. The performances will of course be different than when operating under rated conditions, that is, the temperature rise, starting torque, and other factors may be different than the normal guaranteed values.

When the motor will actually operate on its rated voltage and frequency and the actual load on the motor is known accurately, a 50° centigrade motor can be used instead of a 40° centigrade motor. Such motors will have an observable temperature rise of 50° centigrade instead of 40° centigrade, and may be slightly lower in cost than 40° centigrade motors.

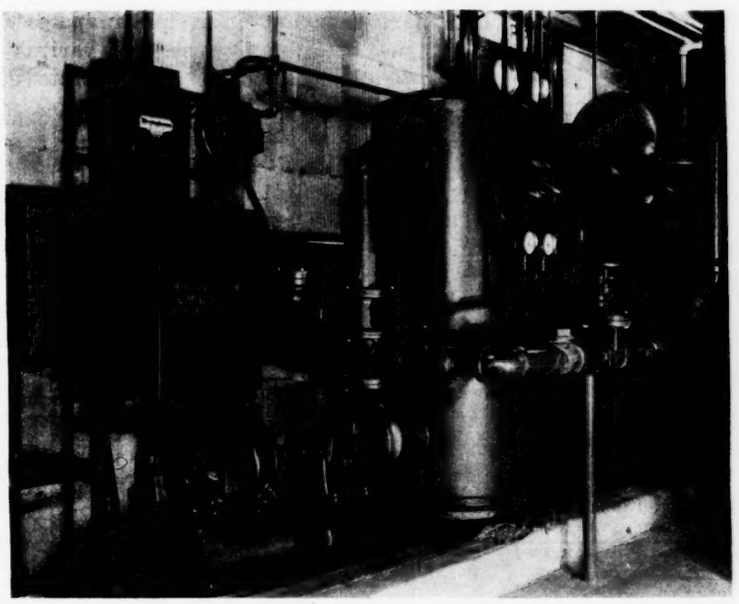


Direct Current Motors Driving Centrifugal Pumps in the Salmon Tower Building, New York

Many buildings are on A.C. network systems in large cities, where the available voltage for the A.C. motors may be 3 phase, 208 or 199 volts. These voltages are within 10% of 220 volts so that standard three phase, 220 volts, 40°C. A.C. motors will operate successfully at such voltages, but will have lower starting torques and slightly higher temperature rises than if operated at rated voltage. If it is necessary for motors to operate on 208 or 199 volt, 3 phase circuits and still meet guaranteed performances and have "service factors" equivalent to those of standard motors, specially designed

motors can be obtained for this purpose. In some cases, auto transformers are added to the main power circuits to step the voltage up from 208 or 199 volts to 220 volts so that standard 220 volt motors can be used.

Motors driving pumps or other equipment in a building should be installed in locations where they are readily accessible for oiling or repairs and in such a way that their ventilation is not restricted.



Squirrel Cage Induction Motor Driving a Return Line Vacuum Pump in the Grant Building, Pittsburgh

Most pump equipments for buildings are supplied complete with motors mounted on the pump bedplates by the pump manufacturers, so that the heating contractor is usually not required to select the actual horsepower of the pump motor.

Pumps are generally rated in gallons per minute capacity when pumping against a specified head in feet of water. The horsepower requirements for the driving motor may be given by the formula:

$$\text{Horsepower} = \frac{\text{Gallons per minute x total head in feet of water}}{\text{Pump efficiency x 3960}}$$

The pump efficiency in this formula is expressed as a decimal, and the total head should include friction head as well as the total lift. For approximate estimating purposes, the efficiency in the above formula may be taken between 60 and 70% for normal centrifugal pumps.

It is suggested by the American Society of Heating and Ventilating Engineers that where 40° centigrade motors less than 100 horsepower in size are used, the horsepower of the driving motor be at least 5% more than the actual horsepower required by the pump at the normal rated capacity conditions for which the pump is guaranteed. If 50° centigrade rated motors are used, the horsepower ratings are to be at least 20% more than the actual required horsepower guaranteed for the pump.

The horsepower rating of a centrifugal pump motor should be at least equal to the maximum value of horsepower which the pump may require between "shut off" and "free delivery" at the highest rated speed of the motor. This will insure that the motor will not be overloaded in case the head is decreased.

Most motors driving pumps in buildings are equipped with magnetic starters. A squirrel cage motor can be equipped with a magnetic starter of one of three classes:

1. Across the line starter.
2. Reduced voltage auto transformer starter.
3. Reduced voltage resistance type starter.

A starter of across the line type consists of a 3-pole magnetic switch which is used to connect the squirrel cage motor directly across the line when the pump is to operate. Overload protection is supplied by a relay, usually of the thermal type, which trips out the magnetic switch if the line current maintains too large a value. This type of starter is simple, reliable, and inexpensive, and is used where there is no objection to starting the pump motor across the line.

Reduced voltage auto transformer starters are made up of a combination of two or more magnetic switches and an auto transformer. The control is arranged so that the auto transformer is first connected to the line to supply a reduced voltage to the squirrel cage motor. After a predetermined time, which will allow it to come up to speed, the squirrel cage motor is switched over to full line voltage and the auto transformer is disconnected from the line.

A resistance type starter usually consists of two magnetic contactors and a bank of resistance. The motor is started by first connecting it to the line in series with the resistances which limit the starting current. After a predetermined time, the other contactor closes its contacts and short circuits the starting resistors, thus connecting the motor directly to the line.

For the reduced voltage alternating current starters, the starting sequence is frequently controlled by a time delay relay, and overload protection may be furnished by a thermal overload relay with normally closed contacts in series with the line magnetic switch.

Resistance-Type Starters Desirable for Centrifugal Pumps

Resistance type starters are used where the power companies' regulations require squirrel cage motors to be brought up to speed without being disconnected from the line during the starting period. They are desirable to use for applications requiring low starting torques, such as centrifugal pumps, where reduced voltage starting is required in order to limit starting currents to lower values than practicable with across the line starting.

A magnetic starter for a direct current motor will consist of a combination of magnetic switches and a starting resistance arranged to start

the direct current motor by first inserting resistance in series with the armature. This resistance is short circuited by one or more magnetic contactors, when the voltage across the motor has risen to a predetermined value (counter e.m.f. acceleration) or when the starting current has dropped to certain values (current limit acceleration). Two or more resistance steps are usually provided.

Magnetic starters for either alternating current or direct current motors can be enclosed in cabinets to prevent exposure of the live parts and to protect the control from most of the surrounding dust and dirt.

Pumps used as part of water supply or vacuum heating systems may be controlled by float switches, pressure regulators, or vacuum regulators which work in combination with the magnetic starters of the pump motors. The float switches, pressure regulators, or vacuum regulators, consist of devices which make an electrical contact when the pump is required to start and break the contact when the pump is to be stopped. The electrical contact is placed in series with the operating coil of a magnetic switch which starts the pump motor.

Standard A.C. or D.C. magnetic starters are always arranged to provide protection against the return of power, after a power failure, by one of two methods. When connected for "low voltage release," the starter will return to the off position when the power fails and will automatically start the motor again when the power returns. The starter will return to the off position when the power fails if supplied with "low voltage protection," but will not start the motor when the power returns until the "start" pushbutton is depressed by a human operator. The usual practice is to provide "low voltage release" for automatic applications such as those using float switches or similar devices, and to furnish "low voltage protection" for non-automatic applications.

A large number of control combinations for pump motors can be worked out using different arrangements of standard pushbuttons, safety switches, and magnetic starters available on the market. A pump motor used with a float switch and a magnetic starter can be connected so that two pushbuttons are used to connect the control either for entirely automatic operation with the float switch or for non-automatic operation by an additional "on-off" push button station.

In many buildings, the house water pumps are arranged so that one, or occasionally more, can be used as spares. The control may be arranged so that a given float switch or a given starter can work with any one of several pump motors. This insures protection against failure of a pump, a motor, or a starter and is easily obtained by means of various combinations of manually operated double throw switches.

In the case of sumps, there may be two vertical motor driven pumps, and float switches may be arranged to start one pump when the motor rises to a predetermined value. If the water level continues to rise, the other pump is started. A further rise in water level may cause a third float switch to close a contact which causes an alarm to be given. A system of transfer switches can be arranged so that either float switch can be made to control either of the two sump pump motors.

Mechanized Weather

AIR conditioning will keep the temperature and relative humidity at the most comfortable and healthful levels for staff and customers in the Bank of Manhattan Company's new quarters at 40 Wall Street.

The basement and basement mezzanine, the safe deposit vault, the security vault and the banking and office working spaces on the first, second and second mezzanine, third, fourth, fifth and sixth floors will be supplied the year round with manufactured weather. No matter how hot or cold, how dry or damp, how humid or foggy it may be outside, everyone in the bank, even those below the street level, will enjoy the equivalent of a balmy spring day. There are few such days in the year outdoors in downtown Manhattan.

Nine air-conditioning units on the various levels will deliver a total of 138,000 cu. ft. a min. of dehumidified, washed and tempered air at a relative humidity of 50%. This means that when the air outdoors in summer has more than this ideal amount of humidity (and this is usually so from May to September) the excess humidity is constantly removed. Automatic thermostats and humidity controls maintain the exact combination of temperature and relative humidity desired. Nine exhaust fans will, when running full blast, exhaust an amount equivalent to the supply air, insuring a constant renewal of room conditions.

In winter, when it is necessary to heat the air delivered by the conditioning machines, outdoor air is preheated before it goes through the spray chambers which wash it free of all dust, dirt and germs and bring it up to the proper degree of humidity. It is then reheated to the desired temperature for delivery into the rooms. The automatic thermostat and humidity controls in this case function so that the air sent through the ducts will be just moist enough to be most healthful and comfortable.

In summer, spring and fall, on days when it is necessary to dehumidify the air for comfort as well as to cool it, the spray water in the conditioning chambers is, of course, refrigerated.

The two centrifugal refrigeration units installed are capable of producing refrigeration equivalent to 460 tons of ice melting each 24 hrs., when cooling 1,580 gal. of water a min. from 54° to 47° F. Of this 460 tons, 55 tons is excess capacity and 100 tons is allowed to provide for future needs when the space supplied with conditioned air may be increased. The present useful load is thus 305 tons. The refrigerating machines are driven by two gear-connected variable speed motors, rated at 1,800 r.p.m., when supplied with 208 volts, 60 cycle, three phase current with variable speed. The allowable speed reduction is 25%.

Water is supplied to the dehumidifiers by individual recirculating pumps taking their supply from a master pump in the basement.

Location	Sq. Ft. Floor Area	Watts	People (Estimated)	Cu. Ft. Per Min. (Supply)
Basement, Safety deposit, Security Vault Working spaces (2 units)	31,702	47,700	335	22,500
1st floor—Working space	7,568	11,350	110	8,500
2nd and 2nd mezzanine	8,440	12,630	95	9,000
Banking (2 units)	14,985	22,475	198	17,500
3rd floor—Bank and Working spaces	25,540	38,200	342	25,000
4th floor—Bank and Working spaces	25,540	38,200	342	25,000
5th floor—Bank and Working spaces	25,540	38,200	342	25,000
6th floor—Bank and Working spaces	23,650	35,400	320	25,000

Time Lag in Heating—Intermittent vs. Continuous Operation

by **F. E. GIESECKE, Ph. D.**

Director, Texas Engineering Experiment Station, A. and M. College

THE materials of which a building is constructed and those which are contained within it have a definite capacity for the storage of heat. For example, about 20 B.T.U. must be stored in 100 lb. of brickwork, about 40 B.T.U. in 100 lb. of books, and about 100 B.T.U. in 100 lb. of water, if the temperatures of these materials are to be raised one degree.

In the study of the heating of a dormitory having a heat loss of about 1.000,000 B.T.U. per hr., when the indoor temperature is 70° F., and the outdoor temperature is 20° F., it was found that the materials of which the building is constructed and those which it contains, including, of course, the heating system and the water within it, require,

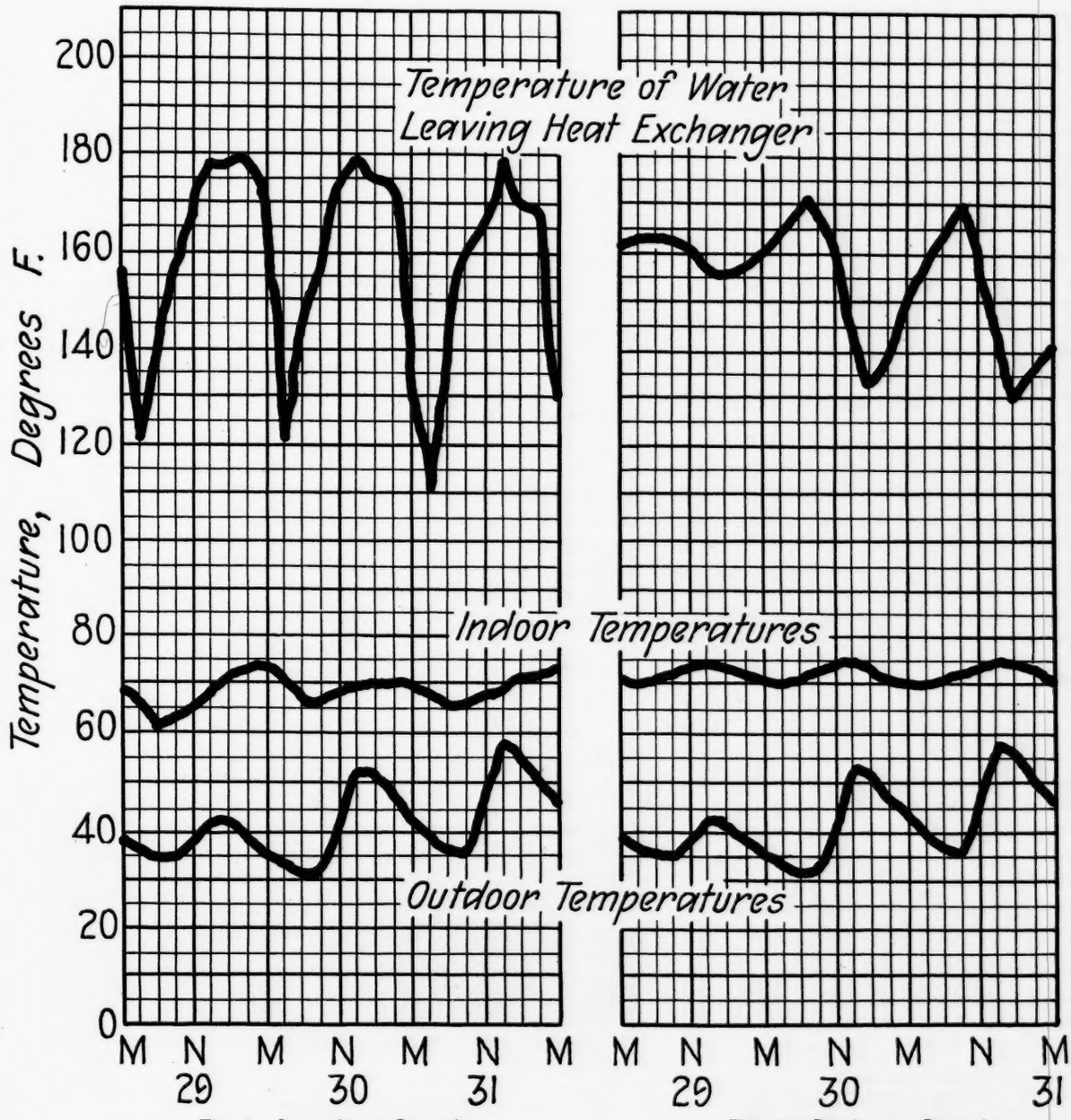


Fig. 1. Intermittent Operation **Fig. 2. Continuous Operation**

Comparative Temperature Records in Dormitory Heated Intermittently and Continuously

together, the storage of about 1,200,000 B.T.U. when their temperature is to be raised one degree.

Consequently, when this dormitory and its contents are allowed to cool to 60° before the heating system is put into operation, it will require about 12,000,000 B.T.U. to raise the temperature to 70° in addition to the quantity of heat which must be supplied to the building to replace that which is being lost to the outside during this heating-up period.

Similarly, if the building and its contents have been heated to 80° by the action of the sun, when suddenly the outdoor temperature drops to 60°, the heat stored in the building and its contents, about 24,000,000 B.T.U. between the temperatures of 60° and 80°, is available to supply the occupants of the building and to replace that which is being lost to the outside, pending the beginning of the operation of the heating system.

The influence of the heat stored and to be stored in the fabric of the building and in the building contents which tends to make the indoor temperature fall and rise more slowly than the outdoor temperature, and also more slowly than that of the medium used for heating the building, is the time lag in heating.

In order to reduce the effect of time lag as much as possible, heating systems should be operated continuously except on those days when the outdoor temperature is not sufficiently low to produce a material cooling of the building and its contents during that part of the 24-hour day when the heating system is not being operated.

Fig. 1 shows a record of the heating of the dormitory referred to above for January 29, 30, 31, 1930, when the heating system was being operated intermittently.

The heating system is a hot water system using partly forced circulation and partly gravity circulation, the water being heated in a heat exchanger by means of live steam. On the three days in question, the steam was evidently cut off at about 9 p.m. and turned on at about 3 a.m. On January 30, the water in the heating system had cooled to 120° at 3 a.m. and was then slowly heated to 180° by 3 p.m.; on January 31, the water was allowed to cool to 110° by 3 a.m. and then again slowly heated to 180° by 3 p.m.

In the meantime, the room temperature, which had been at a maximum of 75° at midnight, cooled to a minimum of 65° at 9 a.m. and then rose to a maximum of 70° at 3 p.m. which it maintained until midnight and then cooled again to a minimum of 65° at 9 a.m.

The result of the intermittent heating shown in Fig. 1 was that on all three days the rooms were coolest at 9 a.m. and warmest at midnight, a condition which is almost exactly the reverse of that which should exist. From these results it is safe to conclude that the method of heating represented by Fig. 1 is one that should *not* be used.

Fig. 2 shows a recommended system of heating, based on the same outdoor temperatures as those shown in Fig. 1 but for indoor temperatures varying from a minimum of 70° at midnight to a maximum of 75° at 3 p.m., and based on a continuous operation of the heating system.

A comparison of Figs. 1 and 2 shows that with a continuous operation of the heating system much more satisfactory indoor temperatures may be secured; also that the heating can be accomplished with a lower maximum water temperature, or, with a smaller quantity of radiation if a definite maximum water temperature is specified.

It is of interest here also to note that the estimated cost of heating the dormitory by the method shown in Fig. 2 is about 2-1/3 cents per student per day, for the three days shown in Fig. 2, the estimate being based on the outdoor and indoor temperatures shown in Fig. 2, on a population of two students per room, and on a cost of 35 cents per million B.T.U.

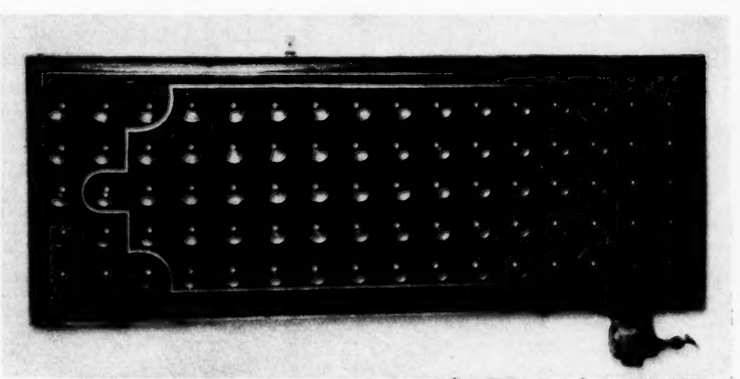
The Original Light-Weight Radiator

Who made the first light-weight radiator? Without going back to ancient history and the use by the Romans of copper hot-water containers, it is probable that the Gold sheet metal radiator, originated by Samuel F. Gold about 1859, is entitled to that distinction. This particular heating surface is more commonly known as the mattress radiator, due to its appearance caused by riveting at frequent, uniformly-spaced centers, to afford the necessary strength to resist internal pressures.

When Mr. Gold was working for his father, as a boy, he noticed how much heat was given off by sheets of Russia iron which he was fitting together by hand to form a condenser for a steamboat engine. His observation convinced him of the possibilities of Russia iron for use as radiators. The steamboat experiment was not a success, but the radiators made from these sheets and which he installed in his father's residence proved so efficient that they were considered much better than pipe-coil surface. In fact, they were such a success that the H. B. Smith Company took them over and began their manufacture.

As fabricated, the supply valve was an integral part of the radiator. This valve had a cast-iron body with an oval nozzle. The sheets of radiator were flared out to receive the nozzle of the valve. A clamp, split in halves, was bolted over the flared edges of the sheets and onto the nozzle, with a liberal application of red lead and oil between the sheet metal and the valve nozzle. Remarkably little trouble was experienced in keeping these joints tight, although they constituted the weakest section of the construction. Air vents were tapped into the ends opposite the supply connections.

The sheets were spaced about ¾ in. apart. To make a tight joint the edges of the sheets were double-seamed and soldered and the whole assembly painted in the shop.



Sheet Metal Steam Radiator Installed at Bristol, R. I., About 1860

Economics of Thermal Building Insulation

Part II

by **PAUL D. CLOSE**

Variation in Thickness With the Outside Temperature

ONE function of an insulation is to conserve fuel during the heating season. Obviously, the colder the climate the greater the thickness of insulation required from the fuel saving standpoint, other things being equal. This fact is clearly illustrated by Fig. 4, which is also based on the problem previously cited and is derived from the following equation:

$$Y_c = 0.0456 \times (t - t_a) - 0.87 \quad (12)$$

It is apparent that a decrease in the average outside temperature (t_a) results in an increase in the insulation thickness (Y_c), if the inside temperature (t) is constant. For the problem under consideration, the insulation thickness becomes zero when ($t - t_a$) is 19.1 F. Since in this case, $t = 77$ F., the average outside temperature at which the insulation thickness becomes zero (based on a 20% return on the investment) is 57.9°, which is approximately the average temperature during the heating season in Mobile, Ala. If the same building were located in Washington, D. C. (average outside temperature, 43.2°), 0.67 in. of insulation would be required, whereas if it were located in Detroit, 1 in. should be used, as previously indicated. On the other hand, if the building were located still farther north in Havre, Mont., where the average outside temperature is 27.7°, the thickness required would be 1.38 in. In Winnipeg, Manitoba, where the temperature from October 1 to May 1 averages 17.2°, 1.86 in. of insulation should be used.

It might be inferred that no insulation is needed if a building is located in a climate similar to Mobile, Ala. This, however, is not true. It means that for the specific conditions involved, not even the smallest thickness of insulation will pay the desired return on the investment, when considered solely from the fuel saving standpoint. For other conditions—that is, for a different type of construction, or for any variation in any of the factors taken into consideration in this problem—a considerable thickness of insulation might be warranted, even in Mobile, Ala. Furthermore, insulation is especially valuable in warm climates for keeping the heat out during the hot weather; in fact, this is the primary object of using insulation in the southern states. Besides, a severe

Fig. 4. Variation in Thickness of Insulation with Average Outside Temperature.

Based on the following conditions:
Roof construction: 2 in. planks, built-up roofing.
Cost of coal: $9 per ton.
Air temperature at roof: 77° F.
Return on investment: 20%.
Cost of insulation, installed: 11c per sq. ft. per in. thickness.
Conductivity of insulation: 0.30 B.T.U. per hr. per sq. ft. per deg. F. per in. thickness.

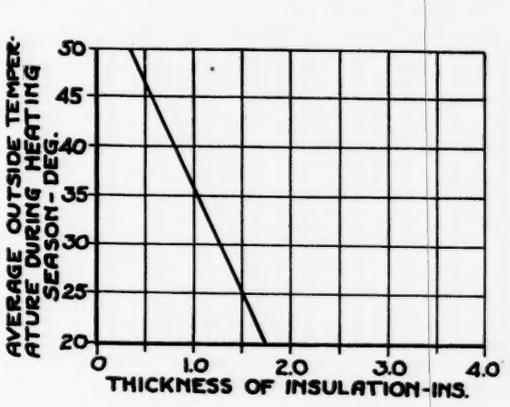


Fig. 5. Variation in Thickness of Insulation with Cost of Insulation.

Based on the following conditions:
Roof construction: 2 in. planks, built-up roofing.
Cost of coal: $9 per ton.
Air temperature at roof: 77° F.
Average outside temperature: 35.4° F.
Return on investment: 20%.
Conductivity of insulation: 0.30 B.T.U. per hr. per sq. ft. per deg. F. per in. thickness.

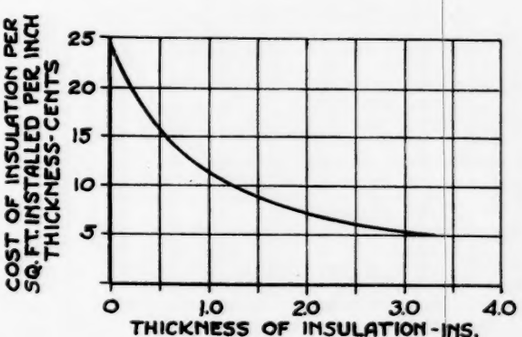
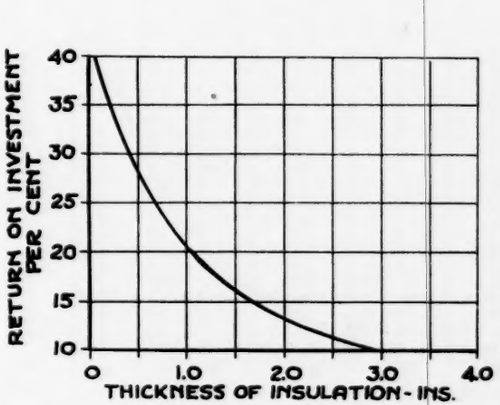


Fig. 6. Variation in Thickness of Insulation with Return on Investment.

Based on the following conditions:
Roof construction: 2 in. planks, built-up roofing.
Cost of coal: $9 per ton.
Air temperature at roof: 77° F.
Average outside temperature: 35.4° F.
Cost of insulation, installed: 11c per sq. ft. per in. thickness.
Conductivity of insulation: 0.30 B.T.U. per hr. per sq. ft. per deg. F. per in. thickness.



condensation problem might necessitate the use of several inches, in which case the condensation would probably be the governing factor rather than the fuel saving or summer heat.

Variation in Thickness With Cost of Insulation

It is entirely logical that unless an insulation is sufficiently cheap, its use is not warranted if the fuel saving derived therefrom is the criterion, because it would be more economical to burn the additional fuel from year to year than to pay the initial cost of the insulation. Consequently, the cost of the insulation must be within reason in order to obtain a satisfactory return on the investment. Of course, a reasonably low price in itself is not sufficient, for the insulation must also have a good efficiency, that is, a low conductivity. The relation between thickness of insulation and the cost of insulation for the problem previously considered is

$$Y_c = \frac{20.9}{z} - 0.87 \qquad (13)$$

The insulation thickness becomes zero in this case when the cost is 24 cents per sq. ft. per in. thickness, installed, and gradually increases as the cost decreases. At a cost of 10 cents, the proper thickness is 1.22 in. The relation between cost and thickness is shown by Fig. 5.

As already stated, the value of z in Formula A is always based on 1 in. of the material. In many cases, the cost varies with the thickness, and it is therefore necessary to make several trial calculations to make sure that the unit cost used in this formula is approximately the correct cost for the thickness required, even though that thickness may be more or less than 1 in.

Variation in Thickness With Return on Investment

As already pointed out, the insulation thickness diminishes as the desired return on the investment increases. For a building located in Detroit with a 2-in. plank roof, covered with built-up roofing, the relation between the return on the investment and the thickness of insulation is given by the following equation:

$$Y_c = \frac{38}{r} - 0.87 \qquad (14)$$

This relationship is based on an air temperature near the roof of 77°,

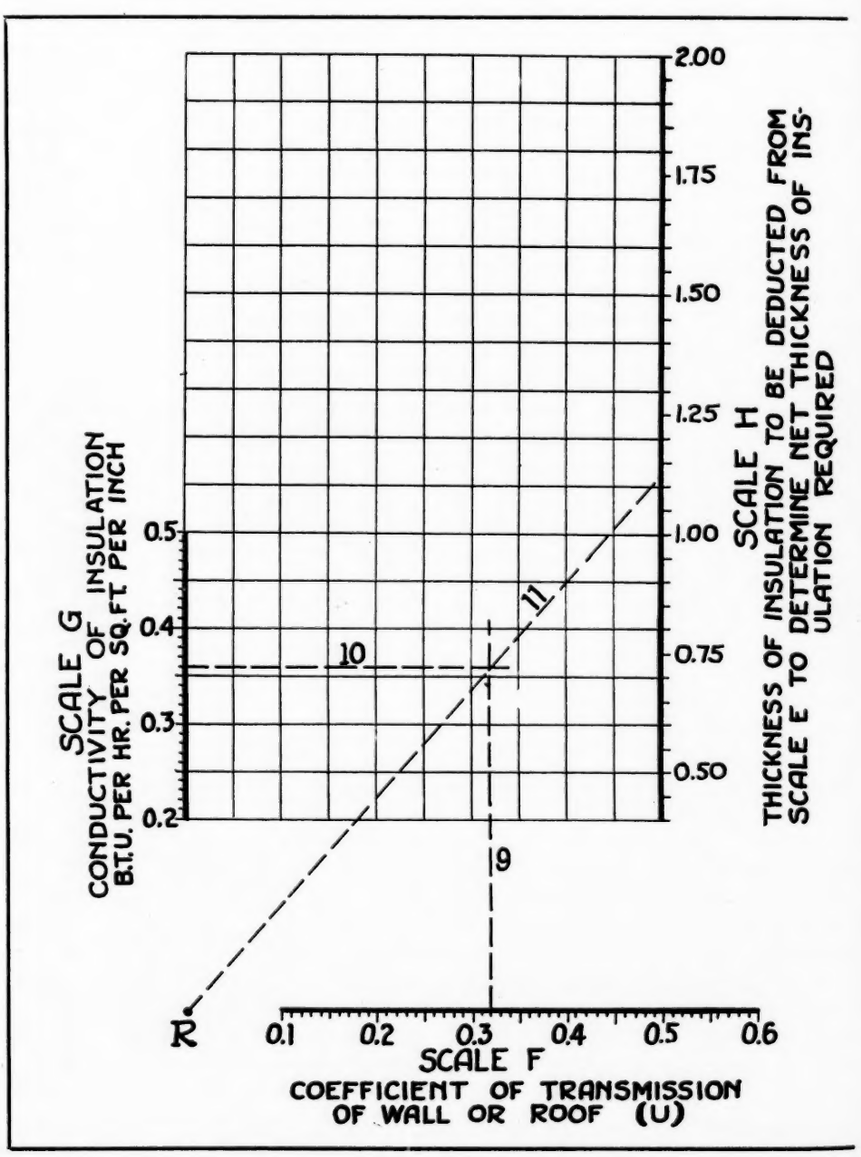
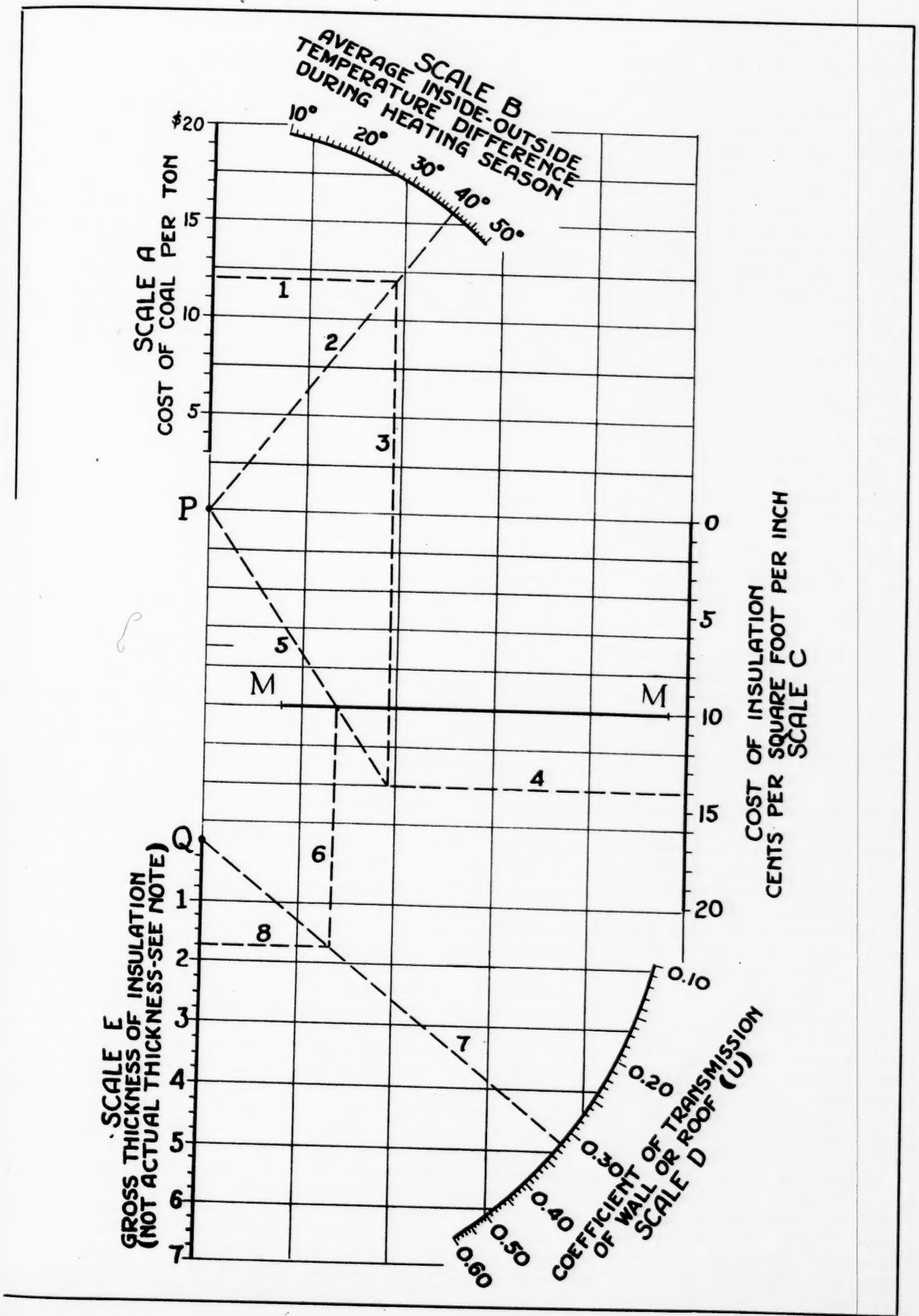


Fig. 7. Charts for Estimating Thickness of Insulation in Coal Heated Buildings.

Scale A. Cost of coal per ton.
Scale B. Average inside-outside temperature difference during heating season.
Scale C. Cost of insulation per square foot per inch.
Scale D. Coefficient of transmission (U) of wall or roof.
Scale E. Gross thickness of insulation (not actual thickness—see note).
Scale F. Coefficient of transmission (U) of wall or roof.
Scale G. Conductivity of insulation per inch.
Scale H. Thickness of insulation to be deducted from Scale E to determine net thickness of insulation required.

Note: The actual thickness of insulation is obtained by subtracting the thickness derived from Scale H from the thickness obtained on Scale E.
Dotted lines indicate solution of typical problem in the order indicated by numbers.


SCALE B
AVERAGE INSIDE-OUTSIDE TEMPERATURE DIFFERENCE DURING HEATING SEASON
10°
20°
30°
40°
50°
SCALE A
COST OF COAL PER TON
$20
15
10
5
1
2
3
P
5
M
M
4
Q
6
8
7
SCALE E
GROSS THICKNESS OF INSULATION (NOT ACTUAL THICKNESS-SEE NOTE)
0
1
2
3
4
5
6
7
0
5
10
15
20
COST OF INSULATION
CENTS PER SQUARE FOOT PER INCH
SCALE C
0.10
0.20
0.30
0.40
0.50
0.60
COEFFICIENT OF TRANSMISSION OF WALL OR ROOF (U)
SCALE D

an insulation cost (installed) of 11 cents per sq. ft. per in. thickness, a conductivity of 0.30 and a fuel cost of $9 per ton. The graphic relationship is indicated by Fig. 6, from which it will be noted that the insulation thickness begins at 43.7%, and increases to 2.93 in. at 10%.

Each additional increment of insulation will pay a smaller return for the money expended than the preceding increment, provided the unit cost remains the same. In the foregoing problem, the first 1/10 in. will pay a return of 38.8%; the second 1/10 in., 31.7%; the third 1/10 in., 26.2%; the fourth 1/10 in., 22%; the fifth 1/10 in., 18.9%; the sixth 1/10 in., 16.3%; the eighth 1/10 in., 12.5%; the tenth 1/10 in., 9.9%; the twelfth 1/10 in., 8.0%; the fourteenth 1/10 in., 6.65%; and so on. It should be noted that although a 1-in. thickness pays a return of 20%, the first 1/10 in. pays 38.8%, and the last 1/10 in. pays 9.9%. The average return for the 1-in. thickness is the logarithmic mean of the returns for the successive increments between 0 in. and 1 in.

Basis for Determining Proper Return on the Investment for Use in Formulae

The foregoing analysis has a bearing on the determination of the return on the investment that should be used in ascertaining the proper thickness of insulation for any given set of conditions. This thickness might well be governed by the rate of change of the return on the investment, rather than the overall return on the investment for the entire thickness of insulation used. Thus, the limiting value of the thickness might be that thickness at which the rate of change of the return on the investment is some given percentage —say 6%. It seems logical, however, that the limiting value of the thickness should be set at an instantaneous return higher than 6%, since this is the standard money rate in many localities, and some allowance should be made for depreciation of insulation, repairs, insurance, etc.

The formula for estimating the thickness of insulation (Y_c) for coal heated buildings on the basis of the instantaneous return on the investment (I_r) at the thickness (Y_c) is as follows:

$$Y_c = k \times \sqrt{\frac{3.23 \times c \times (t - t_a)}{k \times z \times I_r}} - \frac{k}{U} \qquad \text{(Formula B)}$$

If, in the problem previously cited, it is assumed that the instantaneous return on the investment shall not be less than 10%, and the proper values substituted in Formula B, it will be found that the thickness of insulation on this basis is 0.95 in., as compared with 1 in. on the basis of an overall return on the investment of 20%, when using Formula A. The result using Formula B is obtained as follows:

$$Y_c = 0.30 \times \sqrt{\frac{3.23 \times 9 \times (77 - 35.4)}{0.30 \times 11 \times 10}} - \frac{0.30}{0.345} = 0.95 \text{ in.} \qquad (15)$$

Using a thickness of 1 in. and solving for I_r by means of Formula B, the instantaneous return on the investment at a 1 in. thickness is 9.4%.

An insulation problem involving the determination of the proper thickness when coal is used as the fuel, may be solved by either Formula A or Formula B. If Formula A is used, the overall return on the investment for the entire thickness of insulation is taken into consideration. If Formula B is used, the return on the investment for the final increment of the total thickness of insulation is taken into consideration.

Because Formula A is more simple than Formula B, it is recommended for ascertaining the proper thickness of insulation when coal is used as a fuel, and the recommended overall return on the investment for use in this formula is 20%. Formula B is introduced merely to show that the selection of a value of r of 20% for Formula A is not wholly arbitrary because for this overall value the return for the final increment is usually about 10%, which as previously stated seems to be the logical limit.

It will be found from an analysis of a large number of problems that the thickness determined from Formula A, based on an overall return of 20%, when substituted in Formula B, will give an instantaneous return between 9% and 10%, when solving for I_r.

Charts for Estimating Insulation Thickness

In many cases a graphical solution of the problem is more convenient than the formula solution. Fig. 7 may be used for determining the proper thickness of insulation for coal heated buildings. This chart is based on an overall return on the insulation investment of 20%, a heating season of 210 days or 5040 hours, coal having a calorific value of 13,000 B.T.U. per lb., and an overall heating efficiency of 60%. The solution of a typical problem is indicated by the dotted lines, which should be drawn in the order indicated by the numbers. The procedure is as follows:

1. Locate the cost of coal per ton on Scale A, and draw a line horizontally to the right.
2. Find the average inside-outside temperature differences on Scale B (see Table 1) and draw a line to point P. (The inside temperature should be near the wall or roof surface, as the case may be. The outside temperature should be the average for the months of October to April, inclusive, since the chart is based on this period of time).
3. From the intersection of lines 1 and 2, draw a line vertically downward.
4. Locate the cost of the insulation (per square foot per inch thickness, installed) on Scale G and draw a line until it intersects with line 3.
5. From the intersection of lines 3 and 4, draw a line to point P.
6. At the intersection of line 5 with line MM, draw a line vertically downward.
7. Locate the coefficient of transmission of the uninsulated wall or roof on Scale D and draw a line to point Q.
8. From the intersection of lines 6 and 7, draw a line horizontally to the left to Scale E, on which will be indicated the gross thickness of insulation required.

9. Next, locate the coefficient of transmission of the unisulated wall or roof on Scale F, and draw a line vertically upward.

10. Then, locate the conductivity of the insulation on Scale G and draw a line horizontally to the right.

11. Draw a line from point R, through the intersection of lines 9 and 10, to Scale H.

12. The correct thickness of insulation is obtained by subtracting the thickness indicated on Scale H from the thickness indicated on Scale F.

Insulation Thickness Based on Fuel and Radiation

If direct radiation is installed in a building and allowance is made for the saving in radiation made possible by the application of insulation to the walls and/or roof, the thickness of insulation based on any given return on the investment will be greater than for the same return on the investment when only the fuel saving is considered. This is because the monetary value of the radiation saving is deductable from the cost of the insulation, making the net cost for any specified thickness less than when radiation is not considered. Since the net cost is less, the return due to the fuel saving will be greater, and therefore an additional thickness of insulation will be required to reduce the return on the investment to the same percentage, e.g., 20%, as when the fuel saving only is considered.

Derivation of Formula for Coal and Steam Radiation

The derivation of the formula for estimating the thickness of insulation required when both the fuel and radiation savings are taken into consideration is not unlike that for fuel saving only. The derivation of the formula for coal and steam radiation is as follows:

$$F_c = \frac{(U - U_i) \times N \times (t - t_a)}{C_c \times E_c \times 2000} = A \times (U - U_i) \quad (16)$$

$$A = \frac{N \times (t - t_a)}{C_c \times E_c \times 2000} \quad (17)$$

$$r = \frac{F_c \times c \times 100}{\frac{z \times Y_{cs}}{100} - R_s \times s} \quad (18)$$

where

s = monetary value of saving in steam radiation—dollars per square foot

Y_{cs} = thickness of insulation required for coal and steam radiation

R_s = saving in radiation due to installation of insulation—square feet of radiation per 1 sq. ft. of wall area

t_o = outside temperature on which design of heating system is based

$$R_s = \frac{(U - U_i) \times (t - t_o)}{240} = B\,(U - U_i) \quad (19)$$

$$B = \frac{t - t_o}{240} \quad (20)$$

$$r = \frac{A \times (U - U_i) \times c \times 100}{\frac{z \times Y_{cs}}{100} - B \times (U - U_i) \times s} \quad (21)$$

$$Y_{cs} = \frac{10{,}000 \times A \times c \times U + 100 \times B \times r \times s \times U}{r \times z} - \frac{k}{U} \quad (22)$$

$$= \frac{\frac{5 \times N \times c \times (t - t_a) \times U}{C_c \times E_c} + 0.417 \times r \times s \times (t - t_o) \times U}{r \times z} - \frac{k}{U} \quad (23)$$

Let N = 5040, C_c = 13,000, and E_c = 0.60

Then—

$$Y_{cs} = \frac{3.23 \times (t - t_a) \times c \times U + 0.417 \times (t - t_o) \times r \times s \times U}{r \times z} - \frac{k}{U}$$

(Formula C)

Formula for Coal and Hot Water Radiation

The derivation of the formula for coal and hot water radiation is the same as for steam radiation, except-

ing that $B = \frac{t - t_o}{160}$, and h = monetary value of saving in hot water radiation, expressed in dollars per square foot.

TABLE 1. AVERAGE OUTSIDE TEMPERATURE FROM OCTOBER 1 TO MAY 1 FOR VARIOUS CITIES IN THE UNITED STATES AND CANADA

Albany, N. Y.	35.1
Atlanta, Ga.	51.4
Baltimore, Md.	43.6
Birmingham, Ala.	53.9
Bismarck, N. D.	24.5
Boston, Mass.	37.6
Buffalo, N. Y.	34.7
Burlington, Vt.	29.3
Charleston, S. C.	56.9
Chicago, Ill.	36.4
Cleveland, Ohio	36.9
Columbus, Ohio	39.9
Denver, Colo.	39.3
Detroit, Mich.	35.4
Dubuque, Iowa	33.9
Duluth, Minn.	25.1
El Paso, Texas	53.0
Evansville, Ind.	40.2
Ft. Worth, Texas	54.7
Green Bay, Wis.	28.6
Havre, Mont.	27.7
Indianapolis, Ind.	40.2
Jacksonville, Fla.	61.9
Knoxville, Tenn.	47.0
LaCrosse, Wis.	31.2
Lincoln, Nebr.	37.0
Little Rock, Ark.	51.6
Los Angeles, Cal.	58.6
Louisville, Ky.	45.2
Memphis, Tenn.	50.9
Milwaukee, Wis.	33.0
Minneapolis, Minn.	29.6
Mobile, Ala.	57.7
New Haven, Conn.	38.0
New Orleans, La.	61.5
New York, N. Y.	40.3
Norfolk, Va.	49.1
Oklahoma City, Okla.	48.0
Philadelphia, Pa.	41.9
Phoenix, Ariz.	59.5
Pittsburgh, Pa.	40.8
Pocatello, Idaho	36.4
Portland, Me.	33.6
Portland, Ore.	45.9
Providence, R. I.	37.6
Raleigh, N. C.	49.7
Richmond, Va.	47.4
St. Louis, Mo.	43.3
Salt Lake City, Utah	40.0
San Antonio, Texas	60.7
San Francisco, Cal.	54.3
Sante Fe, N. M.	38.0
Savannah, Ga.	58.4
Seattle, Wash.	46.3
Shreveport, La.	56.2
Spokane, Wash.	37.5
Springfield, Ill.	39.9
Springfield, Mo.	43.0
Vicksburg, Miss.	56.0
Washington, D. C.	43.2
Wilmington, N. C.	53.1
Montreal, Quebec	27.4
Ottawa, Ont.	26.9
Pt. Arthur, Ont.	21.6
Prince Albert, Sask.	14.7
Quebec, Que.	24.4
Toronto, Ont.	32.0
Victoria, B. C.	43.8
Vancouver, B. C.	41.7

Y_{ch} = thickness of insulation required for coal and hot water radiation

$$= \frac{3.23 \times (t - t_a) \times c \times U + 0.625 \times (t - t_o) \times r \times h \times U}{r \times z} - \frac{k}{U}$$

(Formula D)

Typical Problem Involving Fuel and Radiation Savings

If in the problem originally cited a steam heating system is installed and allowance is made for radiation saving, the thickness of insulation required would be determined by means of Formula C. Let it be assumed that the monetary value of the radiation saving (s) is $0.50 per sq. ft. and that the base temperature (t_o) is zero. The required thickness of insulation would be, Y_{cs}, =

$$\frac{3.23\ (77-35.4)\ 9\ (0.345 + 0.417)\ (77-0)\ 20 \times 0.50 \times 0.345}{20 \times 11} - \frac{0.30}{0.345}$$

$$= 1.53 \text{ in.}$$

This compares with 1.03 in. if fuel only is considered or an increase of 1/2 in. due to the radiation saving. If the value of the radiation saved were $1 per sq. ft. instead of $0.50, the thickness required would be 2.04 in. instead of 1.53 in.

If a hot water system were installed, Formula D would be used, and the thickness of insulation required based on a radiation value of $0.50 per sq. ft. would be 1.78 in. instead of 1.53 in.

Other fuels as well as special conditions involving insulations used in place of other materials, as well as insulations which when installed increase or decrease the number of air spaces in the wall or roof, will be treated in subsequent issues.

(To be continued)

Iceland to Use Hot Springs for Heating

ICELAND is planning to use its numerous springs of boiling and warm water as a source of heat and power for its capital, Reykjavik, according to a report from Consul General North Winship at Reykjavik made public by the Department of Commerce, which follows:

Experiments using these springs, which arise from Iceland's volcanic origin, have so far shown very favorable results. The first drillings were begun about two years ago by the Icelandic Engineering Association at Wash Springs, about two miles from the capital. The subterranean heat has been successfully used in heating houses, in cooking and washing and in warming the soil. It is expected that the present project will be completed by the fall of this year.

Underground Pumping Plant

According to the plan, a pumping plant wil be constructed near Wash Springs. It will be built under ground, and the natural hot water, as it emerges from the ground, will be conducted to a large storage tank and thence forced to the city. The station will be equipped with three centrifugal pumps, two of which will have a capacity of 25 liters per sec., and the third 15 liters per sec. The pumps will be electrically driven and the water will be conveyed into the city through 1.75 mm. seamless steel pipes welded together. The pipes will be insulated with cork, covered with concrete 2 mm. thick, asphalted, and wrapped with jute and felt paper. The pipe line will be fitted with expansion joints every 50 meters.

School, Hospital and Swimming Pool to be Heated

At the city end of the pipe line a pressure regulator will be installed to connect with the electric pumps and to be operated according to pressure requirements. The pipe line will terminate in an air tank that will assure an even flow in the current.

During the coming winter only three institutions will be heated by water from Wash Springs — the National Hospital, a school, and an indoor swimming pool. It is probable that a storage tank will be erected in the city early next year for storing the surplus water that accumulates during the night. Such storage should greatly enhance the effectiveness of the entire system and is expected to make it possible to heat all the public buildings in this manner.

Heat Estimated

On the basis of a water temperature in the radiators of 40° C. (104° F.) it is expected that the system should produce approximately 80,000,000 calories (317,000 B.T.U.) during each 24-hr. period. The pipe system in the several buildings will be installed in the usual manner, with the exception that the radiators will be somewhat larger.

School Finds Mechanical Ventilation Satisfactory

Open-air classrooms at Decatur, Ill., have been discontinued, according to *School Board Journal*, because in the opinion of health experts and the school nursing staff, rooms which are mechanically ventilated, present ideal conditions, with more satisfactory temperatures and comfort.

About three years ago, a suggestion was made to the school nurses that better results might be obtained if the windows of open-air rooms were closed and the ventilating system used. Last year, Dr. O. N. Lindberg, medical director for the Macon County Tuberculosis Sanitarium, began a study of the problem. During the year he carried a number of tests by closing the windows in one of the rooms of the Washington School. The results of the tests have borne out his opinions and the present action is the result of his conclusions.

Dr. Lindberg, as a result of his studies, has recommended that, beginning this fall, the three open-window rooms be known as health rooms and that the windows be closed and the ventilating system used. The tests have proved that the children in the one room under observation received the same good health effects as those children exposed to cold air. Other rooms in the school, Dr. Lindberg concluded, would be benefited by the change.

Under the plan, the 75 children in the three rooms will continue to observe the same health routine as in the past years.

Air Conditioning

IV. Ventilation—Diffusion

by

WILLIAM HULL STANGLE

The accompanying article completes the introductory section of "Air Conditioning." Readers are urged to keep in a handy place the physical data already published as they will have frequent occasion to refer to them when succeeding articles go into the meat of the subject. The complete outline of coming articles follows:

Fans and Drive
Distribution of Air
Outlets and Inlets
Synthetic Atmosphere
Air Conditioning
Air Conditioning Apparatus
Heaters
Washers
Refrigeration
Condenser Water Cooling Systems
Temperature and Humidity Control
Pumps
Piping
Sheet-Metal Work
Acoustical and Heat Insulation
Typical Systems
Calculations
Schematic Specifications and Guarantees

FROM Boyle's Law it is known that the concentration of air is directly proportionate to its absolute temperature and inversely proportionate to its pressure. Since air is a mobile, gaseous fluid with negligible cohesive properties it will flow from a place of higher pressure to one of lower pressure. From this we know that, when heated, and in consequence of the relative increase in pressure, the air will flow to a place where the pressure is lower, and will, in passing to the lower pressure, become somewhat cooler. Also, when air is reduced, by pressure, to a smaller volume, as in compression, it will, because of its increased pressure, flow to a region of lower pressure, and, in passing, will cool, by virtue of its expansion, to a lower pressure or relatively greater volume.

This argues that air to be moved must be slightly compressed to cause it to flow and to overcome the friction of ducts, outlet velocities required and to accomplish the necessary diffusion in the place to be ventilated.

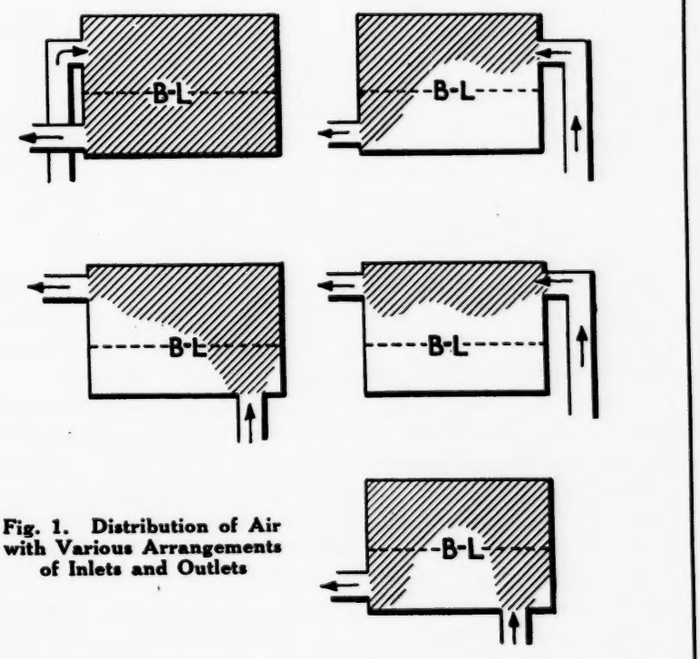


Fig. 1. Distribution of Air with Various Arrangements of Inlets and Outlets

When fresh clean air is introduced into an inhabited space it becomes vitiated by the admixture of carbon dioxide and water vapor from the occupants. These gases diffuse into the clean air, lowering its standard of purity. To lower the vitiation and increase the purity more fresh clean air must be supplied. When reference is made to the fact that the air is changed a certain number of times an hour, it does not mean that the entire space is completely scavanged of all vitiated air and that all new fresh clean air occupies the same space. What it does mean is that enough fresh clean air has been introduced to lower the vitiation and raise the purity of the air to a degree that is recognized as safe and comfortable for the occupant, the degree of purity having been established by test, experiment, law, or judgment of the engineer.

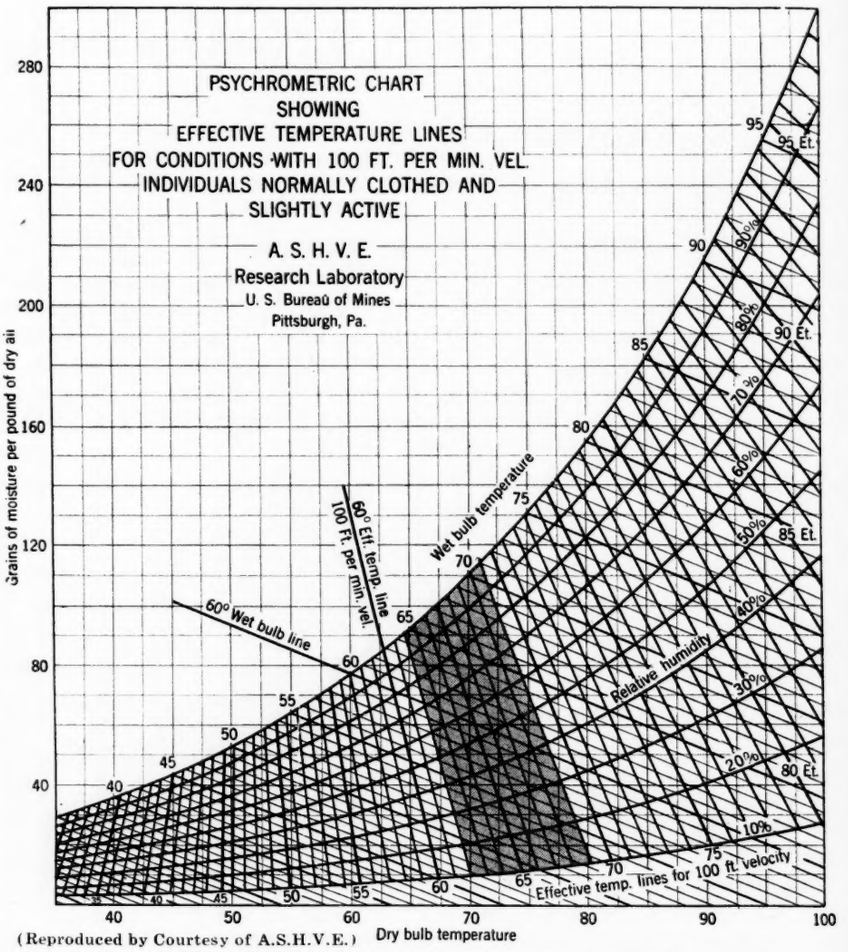
In the case of ordinary mechanical ventilation, the CO_2 content of the air is the factor on which all calculations for ventilation are made. Since the chief source of CO_2 is from the occupant and in proportion to the activities of the occupant, certain fixed rules or laws become operative in the design of ventilation systems.

The pure air that is taken into the lungs contains approximately 20.26% oxygen, 78% nitrogen, 0.04% CO_2 and 1.50% water vapor. The air respired from the lungs contains approximately 16.2% oxygen, 75% nitrogen, 4% CO_2 and 5% water vapor. The expired air leaves the lungs at from 90°-98° F., is from 1 to 3% lighter than when inhaled, and has increased its CO_2 content approximately 100 times, or from about 4 parts per 10,000 to 400 parts per 10,000.

Diffusion of the CO_2 takes place immediately and it is shortly distributed throughout the room. The CO_2 soon rises above 4 parts in 10,000 and the room air is not as pure as the first inhaled air. This

condition is part of the change in confined air and is one of the factors making for vitiation. When the CO_2 content reaches 7 parts in 10,000 it becomes noticeable, and when it reaches 10 parts per 10,000 it causes real discomfort. (It is to be noted that the CO_2 content of fresh air will average 2 to 3 parts in 10,000 in clean country air.) From this the air required per person, to maintain a maximum of 7 parts of CO_2 per 10,000 with 4 parts per 10,000 as an average for fresh air, may be calculated. An adult person at rest inhales about 20 cu. ft. of fresh air at each inhalation and averages from 16 to 24 respirations per min., resulting in a total requirement of from 320 to 480 cu. in. of air per min. or about 0.25 cu. ft., which may be increased to about 0.33 cu. ft. per min. if the person is in active motion.

As the CO_2 content of exhaled air is 400 parts per 10,000, one person will, in one hour, exhale about 0.6 cu. ft. of CO_2. A favorite rule is to allow 500 cu. in. of air per min. per person and expect a vitiation of 17 cu. in. of CO_2 per min. per person. This results in a requirement of approximately 33 cu. ft. per min. or 2000 cu. ft. per hr. per person for air at 4 parts per 10,000 outside and 7 parts inside.



(Reproduced by Courtesy of A.S.H.V.E.)

Psychrometric Chart Showing Effective Temperatures for 100 ft. Air Velocity (Shaded Area Indicates the Comfort Zone)

In addition to the increase in CO_2 due to the exhalation of the occupant, the air increases in heat content and water vapor. The average adult person at rest gives off approximately 400 B.T.U. per hr. to maintain bodily comfort, and up to 800 B.T.U. when at work. Of this, 30% is convected by air, 43% by radiation and 27% by exhalation and other minor means. Now, dry air is a poor conductor of heat, but radiation may take place, and in a hot, dry room, a person may feel the effects of a cold exterior wall, for the high radiation of heat from the body will find a direct path to the colder exterior wall. This one fact has caused many apparently well heated rooms to be pronounced uncomfortable.

Further, an adult at rest will exhale about 0.155 lb. of water vapor per hr., and, when exercising, the amount will increase to about 0.267. Like the CO_2, this vapor will diffuse and result in a vapor content above the point of comfort.

In order that proper ventilation result, fresh air must be supplied and foul or vitiated air must be removed. This may be accomplished by either natural or mechanical ventilation. In natural ventilation systems the air movement is produced in the system by the thermal head, the differential in density between the outer air and the inside air in the system producing the head. The colder the outside air and the hotter the inside air the greater the head. But the coldness of the outside air is not dependable and the temperatures of the inside air are limited.

The more dependable is the mechanical system wherein fans move the air at required velocities and pressures accurately controlled.

Mechanical ventilation may be broadly divided into two systems, the upward system and the downward system.

In the upward system, generally used in auditoriums or other places of comparatively congested occupancy, advantage is taken of the natural tendency for the heat given off by the occupants to rise, and the rising air currents to carry off the products of respiration in the vitiated air. The fresh air is supplied at or near the floor level and the vitiated air is exhausted at or near the ceiling. The disadvantage of this system is that it is difficult to heat the room, as the fresh warm air introduced into the room before it is occupied rises rapidly to the exhaust outlets, resulting in an inefficient heating medium.

In the downward system, generally used in schoolrooms, institutions, and the like, where a less congested occupancy occurs, the fresh air is introduced into the room at a point 8 ft. or more above the floor line and exhausted at or near the floor line. When the supply is 8 ft. or more above the floor line there is little danger of drafts. Best results are produced when the exhaust is on the same side of the room as the supply, as the short circuiting of the air currents is reduced to a minimum, for the supply air must flow out across

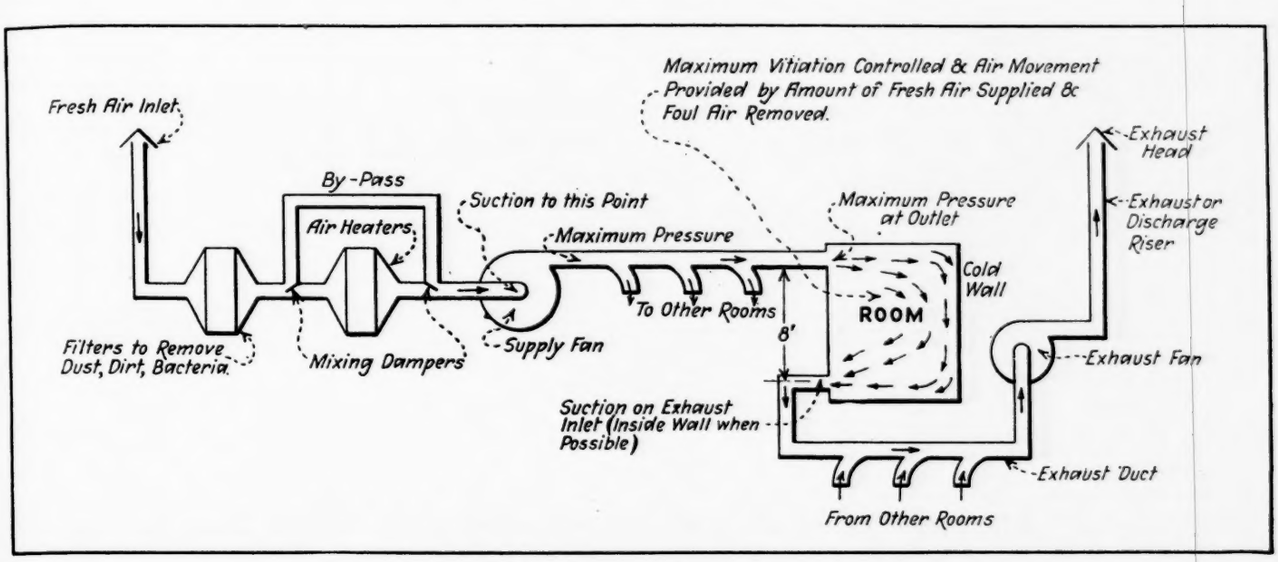


Fig. 3. Schematic Drawing of Simple Ventilating System

the room to the colder outside wall where it is cooled, drop to the floor level and exhaust at the floor level.

If the CO_2 content rises above the maximum for comfort or the water vapor content is higher than that consistent with the effective temperature, discomfort will result. The CO_2 content requirements have been briefly discussed. Fig. 2 shows the relation of temperature and humidity and the zone of comfort or the effective temperature.

In general, a higher temperature and a lower humidity result in a too rapid evaporation of the film of moisture against the body, resulting in chilly feeling. On the other hand, a lower temperature and a higher humidity result in a too slow evaporation and a "close" feeling is experienced.

AIR REQUIRED FOR VENTILATION

Type of Building	Cu. Ft. of Air Required Per Hr. Per Person
Hospitals:	
Ordinary	2500
Surgical cases	3000
Contagious diseases	6000
Schools, theatres, prisons and assembly halls	1800
Factories and shops	2000
Factories (unhealthy trades)	3500

Ventilation, therefore, only partly alleviates the discomfort of the occupant, for it does not produce all the desired conditions for good ventilation and is less dependable to maintain these constant conditions. To produce proper results the air in a room must be synthetically prepared by proper air conditioning. When, for an effective temperature, the air is too dry, water vapor must be added, and when the air is too wet, water vapor must be removed. The adding of water vapor to air is termed humidifying and the removing of water vapor is termed dehumidifying. But this is all part of the subject of air conditioning and will be treated in detail in subsequent articles.

We have now passed through the necessary elementary scientific data and general discussion of ventilation to be prepared for the more complicated and highly practical discussions that have yet to come.

As an intermediate step it is well that a comparison of a ventilation system and an air conditioning system be made at this time. Figs. 3 and 4 will show the differences between the systems.

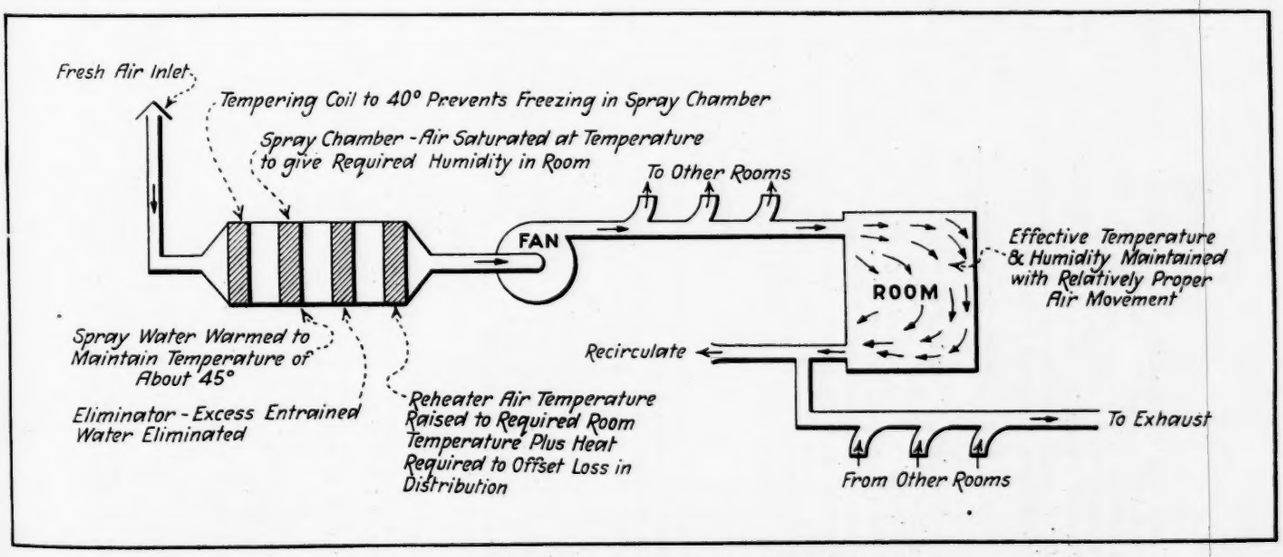

Fresh Air Inlet
Tempering Coil to 40° Prevents Freezing in Spray Chamber
Spray Chamber - Air Saturated at Temperature to give Required Humidity in Room
To Other Rooms
FAN
ROOM
Effective Temperature & Humidity Maintained with Relatively Proper Air Movement
Spray Water Warmed to Maintain Temperature of About 45°
Eliminator - Excess Entrained Water Eliminated
Recirculate
Reheater Air Temperature Raised to Required Room Temperature Plus Heat Required to Offset Loss in Distribution
To Exhaust
From Other Rooms

Fig. 4. Schematic Drawing of Simple Air Conditioning System

FUNDAMENTAL PHYSICAL DATA

Supplementing "Air Conditioning" by William Hull Stangle and Henry Warren Kingsbury

Throttling Calorimeter. In determining the quality of steam, the moisture or wet vapor must be determined. This moisture content is the value "x" in the formula $H = q + xr$ previously given in this text. This determination is accomplished by the use of a throttling calorimeter.

Flow of Steam Through Pipes. Based on Bernoulli's theorem of the flow of water through circular pipes, since steam is a gaseous *fluid* and water a liquid *fluid*, the most popular formulae follow:

$$h = f \times \frac{2L}{D} \times \frac{v^2}{g}$$

where h = loss of head in feet of fluid flowing, f = coefficient of friction, L = length of pipe in feet, D = diameter of pipe in feet, v = velocity in feet per second, and g = acceleration due to gravity.

Flow of Steam Through Orifices. As steam flows from a higher to a lower pressure, it increases as the pressure differential increases. The maximum differential between the absolute terminal pressure and absolute initial pressure cannot exceed 58% with the initial pressure at 25.37 lbs. per sq. in. since 58% of this pressure is one atmosphere or 14.7 lbs. per sq. in.

The formula, under these conditions is

$$W = \frac{pa}{70}$$

where, W = pounds of steam flowing per second, p = absolute pressure in pounds per square inch, and a = area of orifice in square inches. It is to be noted the result is in pounds per second. For pounds per minute multiply by 60.

When the pressure differential is over 58% the following formula applies:

$$W = 1.9\ AK\ \sqrt{(P-d)d}$$

where, W = pounds steam per minute, A = area of orifice in square inches, P = absolute initial pressure in pounds per square inch, d = the pressure differential in pounds per square inch and K = a constant, 0.93 for a short pipe, and 0.63 for a hole in a thin plate, or a safety valve.

Measurement of Steam Flow. Indicating or recording steam meters are designed on the basis of the law that:

$$W = AdV$$

where, W = weight of steam flowing per second, A = area of pipe in square feet, d = density of steam and V = velocity in feet per second.

Air and Other Gaseous Fluids. Air is a gaseous fluid, and gases have fixed laws. The structure of gases from the kinetic-molecular viewpoint aids in the explanation of these laws.

The most important thing to remember about air, or any gas, is that it can be compressed to a great extent. The oxygen in the air can be reduced to more than one two-hundredth of its volume.

Gases are really molecules with tremendous relative space between them. When gases are compressed the spaces decrease, and when they are expanded the spaces increase. The molecules are constantly in motion, dependent in degree upon the temperature and pressure under which they exist. Gaseous molecules do not tend to "settle out." Being in constant motion they must occupy space by moving about in it. They are really in perpetual motion and are in a state of perfect elasticity.

Gases diffuse by virtue of the motion of the molecules. They permeate the spaces.

PROPERTIES OF DRY AIR AT ATMOSPHERIC PRESSURES

Temperature, °F.	Weight, Lbs. per Cu. Ft.	Vol. of 1 lb. in Cu. Ft.	B.T.U. Required to Raise 1 Cu. Ft. 1° F.
0	0.0864	11.60	0.0208
5	0.0854	11.70	0.0206
10	0.0845	11.83	0.0204
15	0.0836	11.96	0.0202
20	0.0828	12.08	0.0200
25	0.0819	12.21	0.0198
30	0.0811	12.34	0.0196
32	0.0804	12.43	0.0195
35	0.0803	12.47	0.0194
40	0.0795	12.60	0.0192
45	0.0787	12.73	0.0190
50	0.0779	12.86	0.0188
55	0.0771	12.99	0.0186
60	0.0764	13.12	0.0185
65	0.0757	13.24	0.0183
70	0.0750	13.36	0.0181
75	0.0742	13.48	0.0180
80	0.0736	13.61	0.0178
85	0.0729	13.73	0.0176
90	0.0722	13.86	0.0175
95	0.0716	13.98	0.0173
100	0.0709	14.10	0.0172
110	0.0697	14.36	0.0169
120	0.0685	14.60	0.0166
130	0.0673	14.85	0.0163
140	0.0662	15.11	0.0161
150	0.0651	15.37	0.0158
160	0.0641	15.62	0.0155
170	0.0630	15.88	0.0153
180	0.0621	16.13	0.0151
190	0.0611	16.38	0.0148
200	0.0602	16.62	0.0146
210	0.0593	16.86	0.0144
220	0.0584	17.12	0.0142
230	0.0575	17.38	0.0140
240	0.0567	17.65	0.0138
250	0.0559	17.90	0.0136
260	0.0552	18.15	0.0134
270	0.0545	18.39	0.0132
280	0.0537	18.63	0.0131
290	0.0530	18.87	0.0129
300	0.0523	19.11	0.0127
400	0.0462	21.63	0.0113
500	0.0414	24.17	0.0102
600	0.0375	26.65	0.0092
700	0.0342	29.20	0.0085
800	0.0315	31.78	0.0078

Fundamental Physical Data (*Continued*)

Specific density of dry air decreases with the temperature. It is expressed in pounds per cubic foot. Specific volume of dry air increases with the temperature. It is expressed in cubic feet per pound.

Specific heat of dry air at constant pressure of the atmosphere is taken as 0.24 B.T.U. It is the amount of heat required to raise 1 lb. of the air 1° F.

Boyle's Law. This law states "volumes occupied by a sample of any gas are inversely proportional to the pressure at each volume." This really applies to an ideal or perfect gas. Practically all gases vary slightly from this law.

PROPERTIES OF VARIOUS GASES
(at 60° F. and 30 in. mercury, dry)

	Weight, Lb. per Cu. Ft.	Gas Constant R	Specific Heat at Constant Pressure	Ratio Specific Heat, Constant Pressure / Specific Heat, Constant Volume
Air	0.0766	53.3	0.2374	1.40
Water Vapor	0.0476	....	0.4655*	1.27
Superheated Ammonia†	0.0476*	90.5	0.5202	1.32
Carbon Dioxide†...	0.1171	35.1	0.2025	1.31
Carbon Monoxide..	0.0741	55.1	0.2425	1.40
Hydrogen....	0.0053	766.0	3.4090	1.40
Oxygen.....	0.0846	48.3	0.2175	1.40
Nitrogen.....	0.0744	55.0	0.2438	1.41
Sulphur Dioxide†...	0.1786*	24.1	0.1544	1.26

*At 32° F.
†Properties of these gases are pronounced variables depending on the pressures and temperatures.

Charles' Law. The fact that "volumes assumed by a sample of gas at different temperatures, the pressure remaining constant, are in the same proportion as the corresponding *absolute* temperatures," is termed Charles' Law.

Mixed Gases—Dalton's Law. When two or more gases are mixed they do not interfere with each other's pressures, provided there is no chemical reaction. Each gas is referred to individually and exerts its own partial pressure, the sum of the partial pressures of the several gases resulting in the total pressure of the gaseous mixture. This is known as Dalton's law of partial pressures.

Considering the above three laws, they may be formulated as follows, to provide a means of calculation for future reference. Boyle's law may be formulated as

$$V_1 \times \frac{P_1}{P_2} = V_2 \text{ (when the final pressure is greater than the initial pressure)}$$

$$V_1 \times \frac{P_2}{P_1} = V_2 \text{ (when the final pressure is less than the initial pressure)}$$

where V_1 = initial volume, P_1 = initial pressure, V_2 = final volume and P_2 = final pressure.

In connection with this law the question "Is the final pressure greater or less than the initial pressure?" should be answered. When it is greater the final volume is less and when it is less the final volume is greater.

Charles' Law as to temperatures may be formulated as

$$V_1 \times \frac{T_1}{T_2} = V_2$$

where V_1 = initial volume and T_1 = initial *absolute* temperature, V_2 = final volume and T_2 = final absolute temperature.

Combining the laws covering the behavior of gases for pressure and temperature, differentials may be formulated as

$$V_1 \times \frac{P_1}{P_2} \times \frac{T_1}{T_2} = V_2 \text{ (where } P_2 \text{ is greater than } P_1)$$

$$V_1 \times \frac{P_2}{P_1} \times \frac{T_1}{T_2} = V_2 \text{ (where } P_2 \text{ is less than } P_1)$$

It must be understood that these formulae are for a perfect gas. Many variations enter into the problem of calculations of gases that are not within the general scope of air conditioning since with air the pressure differentials are small and temperature differentials are not prohibitive as compared to the absolute temperature.

Erratum. In the table, Lineal Expansion of Solids, Page 84 HEATING AND VENTILATING for July, the third column was headed "Co-efficient per 100° F." This should have read "Co-efficient per 1° F."

Estimating and Designing Heating Systems

XI—Properties of Steam

by **FRED W. HANBURGER**

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IN regard to the piping, steam heating systems may be divided into two general classes, the one-pipe and the two-pipe. These may again be classified with respect to the arrangement employed into underfeed, overfeed, overhead, dry-return, wet-return, relief, etc., or with respect to the method of heat transfer into direct and indirect systems.

These terms are well understood but when we approach the nomenclature intended to describe the condition of the steam under which the system is to operate we talk in various languages. One company's vacuum system is another company's low-pressure system and so on. The meaning of the term may be the same but the design does not always produce the results expressed by the name. Merely to call a system a vacuum or vacuum-vapor system does not make it so.

In hot water heating the density of the water is practically the same at all times, but in a steam plant the condition of the steam is constantly changing and its pressure, density and temperature are never the same at any two points throughout its journey through the system. Attempts have ever been made and are being made to standardize and identify the various systems by the boiler pressure but a better standard would be to classify them by terms descriptive of the condition of the steam in the radiators themselves.

The design of steam systems so that they will be amenable to control depends largely on our knowledge of the actions and properties of the steam itself. As stated previously, steam does not obey the laws of perfect gases, and the relation of pressure, volume and temperature must be obtained by test and trial. There are several standard compilations of these results, termed "Properties of Saturated Steam" or in short "Steam Tables," all of which check each other very closely.

To better aid in understanding the steam tables let Fig. 29 represent a tank of 50 cu. ft. capacity with a water container A, mercury U-tube U, pressure gauge G, calorimeter C, vent P and flame B.

Before steam is generated, and with valve M open, the tank is filled with air under a pressure of 14.7 lb. per sq. in. Gauge G registers zero. As we apply heat at B the temperature of the water rises until it reaches 212°, the boiling or evaporation point under an absolute pressure of 14.7 lb. per sq. in.

As the specific heat of water at these lower pressures is unity each pound of water will now contain 1 lb. $(212° - 32°) = 180$ B.T.U. above the freezing point of water. This heat quantity is termed the heat of the liquid or heat in the water and designated by the letter h. For all the pressure prevailing in our heating systems the heat of the water may be determined by subtracting 32 from the temperature of the steam, but in the higher pressures, with a corresponding higher temperature, the specific heat of water increases above unity and the quantity should be taken from the steam tables.

If we continue to apply heat the temperature of the water will not increase if the pressure is kept the same, in this case atmospheric, but all the added heat goes toward changing the water into steam. Thus the added heat is no longer manifest by temperature rise and is termed the latent heat of steam, designated by the letter L, and the amount of heat in B.T.U. necessary to evaporate 1 lb. of water into steam is given in that column, in this case 970.4 B.T.U. The sum of the heat in water and the latent heat is the total heat which at an absolute pressure of 14.7 lb. per sq. in. is found to be 1150.4 B.T.U. The volume in cubic feet for 1 lb. of steam at the various pressures is also given. At atmospheric, or 14.7 lb. absolute, this is 26.79 cu. ft.

For the purpose of illustration let us assume a thin piston of no weight between the air and steam as shown by the line L in Fig. 29. In practice there is always some admixture. As the steam is generated, driving the air before it through pipe P, when the piston has risen so that the volume of steam is 26.79 cu. ft. there will have been 8 lb. of water evaporated and when the tank is entirely filled with steam the amount of water evaporated will be $\frac{50}{26.79} = 1.85$ lb.

At this stage, with all air expelled and the tank filled with steam, if the valves M and N be closed and the heat continued a pressure begins to build up with an increase in temperature at which steam is given off, a slight decrease in the latent heat and a slight increase of the total heat and as more and more steam is generated into the same space, the density becomes greater. Thus, when the gauge registers a pressure of 10 lb. per sq. in., the absolute pressure is $(10 + 14.7)$ lb. $= 24.7$ lb. per sq. in., the temperature of both water and steam is 239.4°, the heat in water is 207.7 B.T.U., the latent heat is 952.5 B.T.U., the total heat is 1160.2 B.T.U. and the specific volume is 16.49 cu. ft. To form the 50 cu. ft. of steam in the tank we would evaporate $\frac{50}{16.49} = 3.03$ lb. of water from receptacle A.

As a pressure of 0.49 lb. per sq. in. will sustain a column of mercury 1 in.

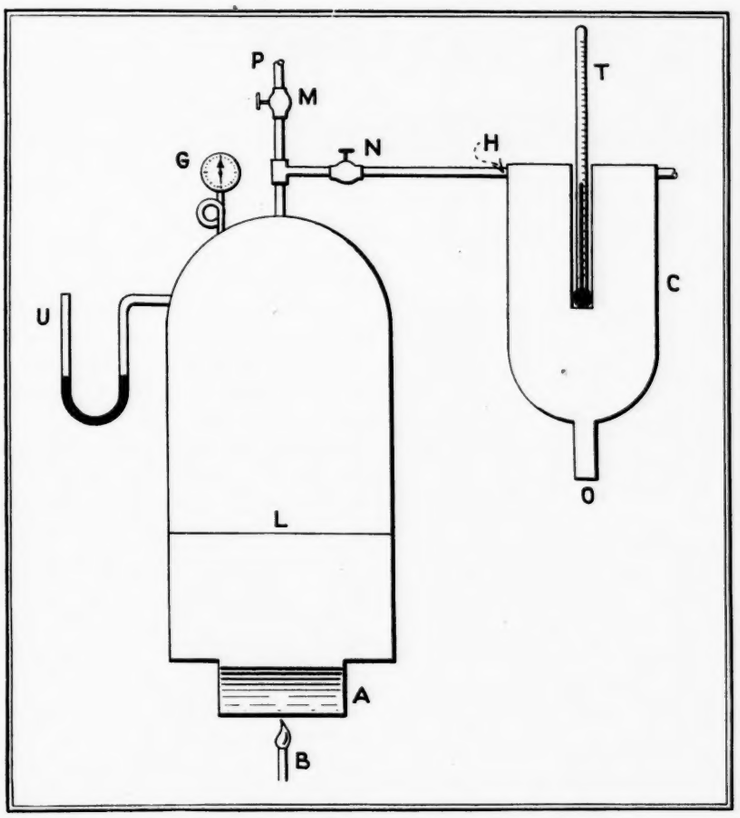

Fig. 29. Diagram Used in Pressure-Volume Problems

high, then with a steam pressure of 24.7 lb. per sq. in. on the inner leg of the mercury U-tube and an air pressure of 14.7 lb. on the outer column there will be a differential of

(24.7 — 14.7) lb. = 10 lb. per sq. in.

and the mercury will rise in the outer leg to a height of

$$\frac{10}{0.49} = 20.4 \text{ in.}$$

above the level of the inner column.

When the flame is taken away evaporation ceases and, as the tank cools, condensation takes place and the pressure and temperature drop. When the gauge drops to zero the mercury columns will again be equal and the temperature of both steam and water will be 212°. Cooling still further, the condensation continues and the pressure and temperature drop. As the pressure of the steam drops below the atmospheric pressure the mercury is seen to rise in the inner leg of the U-tube. The difference in height of the two columns is a measure of the difference in pressure of the outside air and the steam. Taking this difference at any point, say 17.7 in., the difference expressed in pounds per square inch would be

17.7 in. x 0.49 lb. = 8.708 lb.

and the absolute pressure of the steam must be

(14.7 — 8.708) lb. = 5.992 lb. per sq. in.

Referring to the steam tables for this condition we find that the temperature is 170°. If we had an observation glass inserted in the water tank A we could observe the water break into a boiling state at this temperature on the application of the slightest amount of heat. This difference in height of the mercury columns is termed the amount of vacuum, or inches of vacuum, in this case 17.7 in. In a vacuum steam heating system, where this amount of vacuum could be maintained constantly in the radiators, the temperature of the steam would never exceed 170°.

Romancing slightly as an aid in our appreciation of the properties of steam, if we could maintain a vacuum of 29.56 in. in the radiators we find by referring to the steam tables that the steam could never exceed a 50° temperature. We could not utilize it in our house heating as our room temperature must be over this, but no doubt Admiral Byrd on his Antarctic expedition would have found, under above conditions, that the radiators would be quite warm. Every pound of steam traveling to these 50° radiators would need 1063.3 B.T.U. furnished at the boiler to evaporate it into steam.

A vacuum pump on the return line of a heating system can never create a greater vacuum than that corresponding to the temperature of the condensate in the returns, as the water will flash into steam to break any higher vacuum. This is also the case when an attempt is made to pump hot water by suction.

Taking steam with a radiator pressure of 2 lb. gauge pressure, if the condensate left the radiator immediately when formed, and at its temperature of 218.5°, all the heat we could hope to obtain from each pound of steam condensed would be the latent heat, 966.2 B.T.U. The condensate generally passes through the trap at a somewhat lower temperature and has given up a small part of its sensible heat. If in this case it entered the returns at 200° then the amount of heat obtained from each pound of steam would be

966.2 B.T.U. + (218.5° — 200°) × 1 lb. = 984.7 B.T.U.

So far we have been considering steam adjacent to water, a condition which tends toward the formation of saturated steam. Saturated steam does not mean wet steam, as will be explained later, but steam that is at the evaporation temperature corresponding to its pressure, always the case when the steam is in free contact with water. Any attempt to heat the steam to a higher temperature will fail as the steam will readily transfer its heat to the water and cause further evaporation.

In Fig. 29 if we had applied the heat somewhere along the side of the tank instead of at A the conditions would have been the same. However, steam can be heated at a point not adjacent to the water and the temperature raised above the boiling point. This can be accomplished without raising its pressure. Were we to take 16.49 cu. ft. of saturated steam with a gauge pressure of 10 lb., which is just 1 lb. in weight, and further compress it with a piston in a cylinder to 11.99 cu. ft., we would find that it would have a gauge pressure of 20 lb. It will be further

TABLE 14—PROPERTIES OF SATURATED STEAM*

Absolute Pressure	Inches of Mercury Vacuum	Temperature Degrees Fahrenheit	British Thermal Units Above 32° F. Heat in Water	Latent Heat in Steam	Total Heat	Volume of 1 Pound in Cu. Ft.
p	G	t	h	L	H	v
.0886	29.74	32	0.00	1073.4	1073.4	3294.0
.1217	29.67	40	8.05	1068.9	1076.9	2438.0
.1780	29.56	50	18.08	1063.3	1081.4	1702.0
.2562	29.40	60	28.08	1057.8	1085.9	1208.0
.3626	29.18	70	38.06	1052.3	1090.3	871.0
.505	28.89	80	48.03	1046.7	1094.8	636.8
.696	28.51	90	58.00	1041.2	1099.2	469.3
.946	28.00	100	67.97	1035.6	1103.6	350.8
1.271	27.33	110	77.94	1030.0	1108.0	265.5
1.689	26.48	120	87.91	1024.4	1112.3	203.1
2.219	25.41	130	97.89	1018.8	1116.7	157.10
2.885	24.05	140	107.87	1013.1	1121.0	122.80
3.714	22.36	150	117.86	1007.4	1125.3	96.90
4.737	20.28	160	127.86	1001.6	1129.5	77.20
5.992	17.73	170	137.87	995.8	1133.7	62.00
7.51	14.64	180	147.88	989.9	1137.8	50.15
9.34	10.91	190	157.91	983.9	1141.8	40.91
11.52	6.48	200	167.94	977.8	1145.8	33.60
14.7	0.00	212	180.0	970.4	1150.4	26.79
	Gage Pressure					
16.7	2	218.5	186.6	966.2	1152.8	23.80
18.7	4	224.4	192.5	962.4	1154.9	21.36
20.7	6	229.8	198.0	958.8	1156.8	19.45
22.7	8	234.8	203.0	955.6	1158.6	17.85
24.7	10	239.4	207.7	952.5	1160.2	16.49
26.7	12	243.7	212.1	949.6	1161.7	15.34
28.7	14	247.8	216.2	946.8	1163.0	14.33
30.7	16	251.6	220.1	944.2	1164.3	13.45
32.7	18	255.3	223.8	941.7	1165.5	12.68
34.7	20	258.8	227.4	939.3	1166.7	11.99
36.7	22	262.1	230.8	936.9	1167.7	11.38
38.7	24	265.3	234.0	934.7	1168.7	10.82
40.7	26	268.3	237.2	932.5	1169.7	10.32
42.7	28	271.3	240.1	930.5	1170.6	9.87
44.7	30	274.1	243.0	928.5	1171.5	9.45
46.7	32	276.8	245.7	926.6	1172.3	9.07
48.7	34	279.4	248.4	924.7	1173.1	8.72
50.7	36	281.9	251.0	922.9	1173.9	8.40
52.7	38	284.3	253.5	921.1	1174.6	8.10
54.7	40	286.7	256.0	919.3	1175.3	7.82
56.7	42	289.0	258.3	917.6	1175.9	7.56
58.7	44	291.3	260.6	915.9	1176.6	7.32
60.7	46	293.5	262.9	914.3	1177.2	7.09
62.7	48	295.6	265.1	912.7	1177.8	6.88
64.7	50	297.7	267.2	911.2	1178.4	6.68
66.7	52	299.7	269.3	909.7	1179.0	6.50
68.7	54	301.7	271.3	908.2	1179.5	6.32
70.7	56	303.6	273.3	906.7	1180.0	6.14
72.7	58	305.5	275.2	905.3	1180.5	5.98
74.7	60	307.3	277.1	903.9	1181.0	5.83
76.7	62	309.1	279.0	902.5	1181.5	5.69
78.7	64	310.9	280.8	901.2	1182.0	5.56
80.7	66	312.6	282.6	899.9	1182.4	5.43
82.7	68	314.4	284.4	898.6	1182.9	5.30
84.7	70	316.0	286.1	897.3	1183.3	5.18
86.7	72	317.7	287.8	896.0	1183.7	5.07
94.7	80	323.9	294.3	891.1	1185.3	4.660
104.7	90	331.2	301.8	885.4	1187.1	4.241
114.7	100	337.9	308.8	880.0	1188.8	3.890

noted from the tables that the total heat in 1 lb. of steam at 10 lb. gauge is 1160.2 B.T.U. and that a pound of steam at a gauge pressure of 20 lb. requires 1166.1 B.T.U., so that some of the steam must condense. The amount condensed would be

$$\frac{(1166.7 - 1160.2)}{1166.7} = 0.0056 \text{ lb. of saturated steam.}$$

The above is not precisely exact, as the steam would have to have been compressed to about 11.9 cu. ft. to have obtained a pressure of 20 lb. gauge.

If now we release the piston and allow it to come back to its original position this condensation is again re-evaporated, assuming that there is no outside heat loss. If now we further release the piston and let the steam expand until the gauge registers a pressure of 2 lb. a different condition is created. A pound of steam at a pressure of 2 lb. gauge requires a total heat of 1152.8 B.T.U. and as the pound of steam already contains 1160.2 B.T.U. there is an excess of

$$(1160.2 - 1152.8) = 7.4 \text{ B.T.U.}$$

This excess will go toward superheating the steam. The specific heat of steam at this temperature is approximately 0.48 B.T.U. and the rise in temperature will then be

$$\frac{7.4}{0.48} = 15.5°.$$

The temperature of the steam then, instead of 218.5° as given in the tables for saturated steam at 2 lb. gauge pressure, will be

$$(218.5° + 15.5°) = 234.0°.$$

This principle is used to determine the quality or wetness of steam by means of the throttling calorimeter shown at C in Fig. 29. Saturated steam may be dry or wet. If it is dry it is as clear as crystal. If wet the particles of unevaporated moisture give it a cloudlike appearance such as we see issuing from a steam exhaust where some of the steam has been condensed. When steam has been generated too rapidly some moisture has been carried over with the steam. In the throttling calorimeter there is a restricted opening at H and a thermometer in a well at T and a free outlet to the atmosphere at O of Fig. 29.

In the next issue we will discuss the design of steam heating systems. Several problems are given herewith which the student is earnestly requested to work so as to become familiar with the properties of steam.

Problem 1. You have placed a pot full of 60° water on the stove at exactly 5:00 o'clock. It starts boiling at 5.10 o'clock. At what time will the pot be only one-half full?

Problem 2. A blacksmith comes to his shop on a winter morning when the temperature in the shop is 34°. He discharges steam which has a gauge pressure of 10 lb. into the tempering tank which contains 40 gal. of water. After the water has been increased to 41 gal. by the condensation of the steam, what will be the temperature of the water?

Problem 3. The blacksmith of the former example replaces the open steam pipe with a coil and catches the condensate in a separate tank and which he finds emerges at a temperature of 190°. Under the same conditions as in problem 3 and after 1 gal. of condensate has been formed what will be the temperature of the tempering water?

Problem 4. A 2-in. main supplies 300 sq. ft. of cast iron radiation. The average pressure of the steam along the main is 4 lb. gauge and the condensation flows into the returns at a temperature of 200° F. Taking the heat emission for cast iron radiation at 240 B.T.U., what will be the velocity of flow of steam through the main in feet per second? Take the transverse area at 0.023 sq. ft.

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How to Analyze Disc and Propeller Fan Performance

by **CHARLES A. CARPENTER**

ALTHOUGH disc and propeller type fans are used in enormous quantities, there appears to be much confusion as to their real performance. Not infrequently literature describing such fans reveals claims for free air delivery that require up to 500%-600% efficiency. Since it is customary to consider price and claims for capacity, it is well for prospective purchasers to scrutinize competitive ratings in the light of sound science.

In order to explain the engineering background and to simplify analysis of such fans, this article presents some of the mathematical relations and illustrates by diagrams how the buyer may check "wild guarantees" that cannot be met.

There are two fundamental types of fan involved. Disc fans in their elementary state have several flat blades set at a uniform angle to the plane of rotation. Propeller fans have blades with a variable angle to the plane of rotation, the angle increasing from tip to hub.

Disc fans may be modified by curving the blades but maintaining constant angularity. They may also have the blades bent forward at the tip in the direction of air flow.

Propeller fans vary from the true increased-pitch blading through many fancy curves and twists so that most commercial fans are more or less intermediate between true disc and propeller designs and have distinctive modifications in blade shape, in order to force a definite type of air flow or to satisfy some whim of the designer.

It is apparent that the blade action on the air closely follows the theory of the inclined plane. This action is complicated by several factors.

The velocity of any point on the rotating wheel varies as its radius from the center of the shaft.

The blades will slip through the air to a greater or less extent according to design and, of course, due to inertia and friction.

The blades will cause the air to swirl, due to friction of air rubbed by the blades and often due to errors in blade shape.

Due to variable velocity of the air passing from the wheel, there may be sufficient differentials in corresponding pressures to cause backflow at the center of the wheel, "spilling" the air in a radial direction at the tips of the blades, and irregular air velocity, due to lack of sufficient blades or blade surface.

The reader will call to mind various makes of propeller fans and can visualize the designers' reasons for bends at the tips to prevent radial "spilling," center plates or hubs to prevent back flow, varying blade widths to overcome slip and swirl, and differing numbers of blades to maintain uniform flow through the free area of the wheel.

The merits and faults of the many expedients in design are not considered in this article because of the conflicting claims. It is desired to keep these comments general and not to praise or condemn any particular equipment.

Approaching the algebraic solution of increased-pitch or propeller

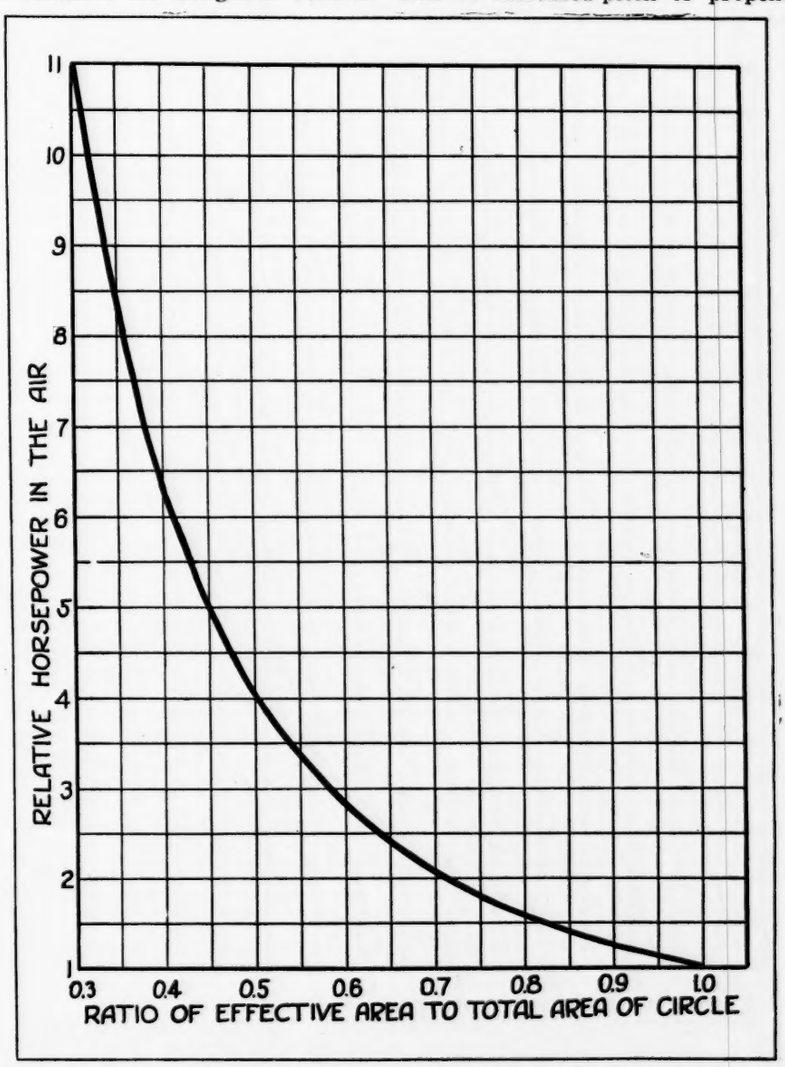


Fig. 1. Effect of Contraction of Area on Air Horse Power

fans, we shall assume in theory that uniform velocity parallel to the shaft is maintained.

Let C = C.F.M.

P = pressure in inches w.g. at 70° F. and 29.92 in. hg.

A = area of circle through which air must pass (usually the diameter of this circle is the diameter of the wheel).

d = diameter of this circle in inches.

f = ratio of net effective area to total area of the circle.

$$V = \text{air velocity} = \frac{C}{fA} = \frac{576C}{\pi d^2 f}$$

a = angle of blade to plane of rotation (angle measured at edge of blade where the air leaves). For this discussion it is assumed that the air leaves at blade angle.

N = R.P.M.

$$\text{Then } V = \frac{\pi dN \tan a}{12} = 4005\sqrt{P}$$

$$= \frac{576C}{\pi d^2 f}$$

$$P = \frac{(576C)^2}{4005^2 \pi^2 d^4 f^2}$$

Horsepower delivered in the air

$$AHP = \frac{CP}{6356} = \frac{576^2 C^3}{4005^2 \times 6356 \pi^2 d^4 f^2}$$

$$= \frac{3297.3\, C^3}{10^{10} f^2 d^4} \text{ for air at } 70° \text{ and } 29.92 \text{ in. Hg.}$$

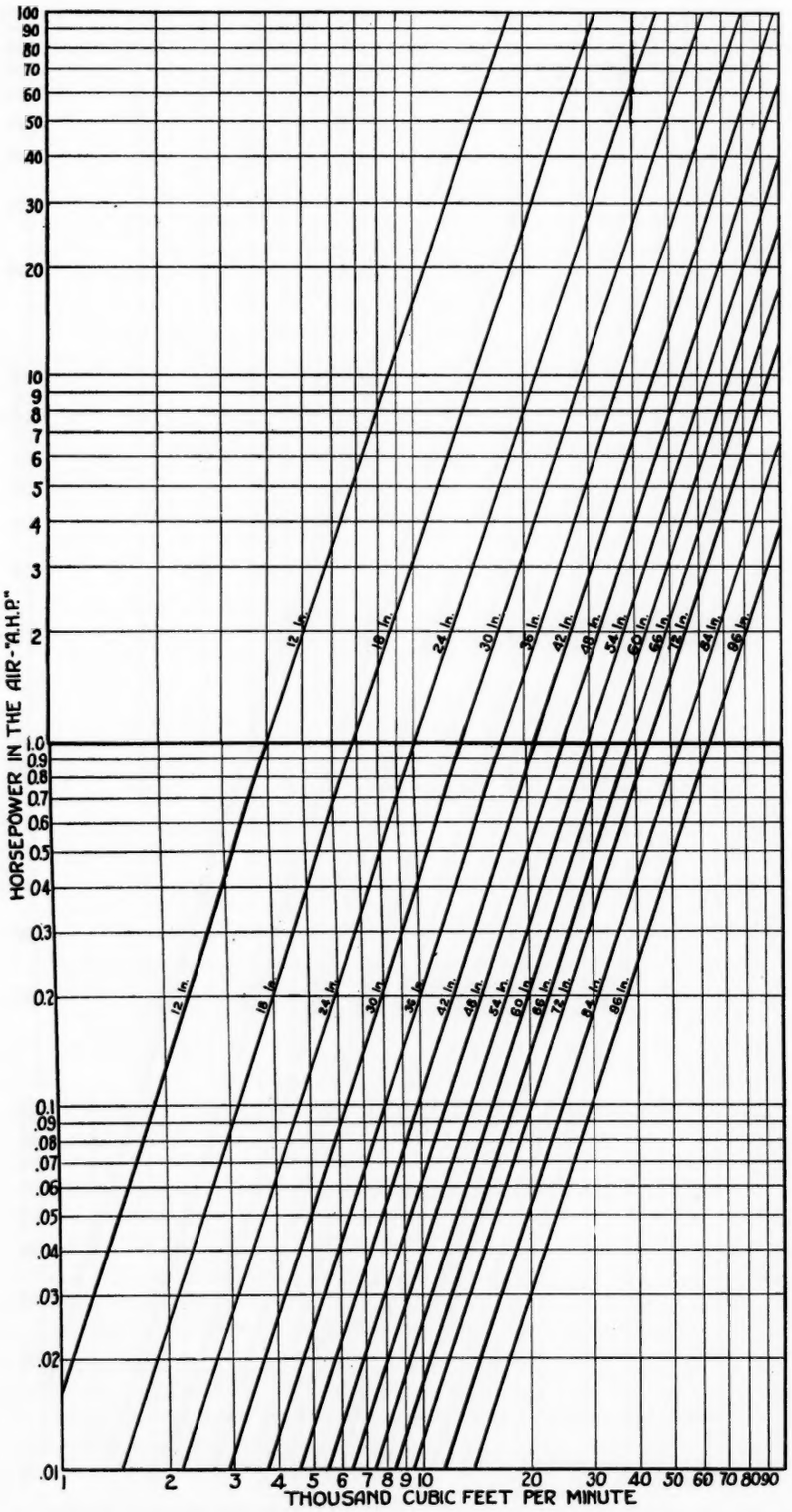


Fig. 2. Relation between C.F.M. and Air Horsepower for Various Diameters

Fig. 1 shows the effect of contraction of area. The factor "f" takes into account center hub or plate, blade dimensions and vena contracta. This factor depends on design, but apparently is under 0.80.

Fig. 2, showing the relation between C.F.M. and air horsepower for various diameters of circles, is derived from the above formula when f = 1.0. That is when the entire circle is considered.

Fig. 3 shows the effect of diameter on air horsepower.

Any claim for a propeller fan when giving free air delivery may be checked by the use of these diagrams to see if the required A.H.P. is consistent with the guaranteed brake horsepower.

The tables show the values from which curves in Fig. 2 were drawn.

Example: From Fig. 1 we determine that air horsepower increases 56.25% if the effective area is 0.8 times the full circular area. The air horsepower to pass 10,000 C.F.M. through a 24-in. circle under these conditions becomes approximately 1.56.

From Fig. 2 it is found that 10,000 C.F.M., passed through a 24-in. circle at uniform velocity, requires slightly under 1 H.P. in the air.

From Fig. 3 it may be discovered that to deliver the same volume of air through a 36-in. circle as through

a 24-in. diameter opening requires $\frac{19.6}{99}$ air horsepower in the ratio of $\frac{19.6}{99}$, or 19.75%.

Therefore, a 36-in. circle passing 10,000 C.F.M. at uniform velocity requires 0.198 A.H.P. and if 0.8 of area be effective the A.H.P. becomes 19.75% of 1.56, or 0.308 A.H.P.

Dividing air horsepower by fan efficiency at free air delivery gives the required brake horsepower.

In order to compare true propeller fans with disc fans, theoretical solutions will be offered, neglecting friction, air slip and other similar factors that influence actual volume delivery and efficiency, but do not vitally upset the comparative value of the following analysis. The solutions are for free air delivery. D = wheel diameter in feet.

Increased-Pitch Propeller Fans

We have noted above that $V = \frac{\pi dN \tan a}{12} = \pi DN \tan a$ (1)

Since $V = 4005\sqrt{P}$,

$$P = \frac{\pi^2 D^2 N^2 \tan^2 a}{4005^2} \quad (2)$$

let a = per cent of diameter in hub and center plate, so net area

$A_1 = \frac{\pi(1-a^2) D^2}{4}$ neglecting blade dimensions and vena contracta, $f = 1 - a^2$

C.F.M. (C) $= VA_1$

$$= \frac{\pi^2 (1-a^2) D^3 N \tan a}{4} \quad (3)$$

$$\text{Air H.P. (A.H.P.)} = \frac{CP}{6356}$$

$$= \frac{\pi^4 (1-a^2) D^5 N^3 \tan^3 a}{4 \times 4005^2 \times 6356} \quad (4)$$

$$\frac{C}{A.H.P.} = \frac{4005^2 \times 6356}{\pi^2 D^2 N^2 \tan^2 a} \quad (5)$$

Flat-Bladed Constant-Angle Disc Fans

$V = \pi DN \tan a$ (for outer rim of wheel only) (6)

$$P = \frac{\pi^2 D^2 N^2 \tan^2 a}{4005^2}$$ (for outer rim of wheel only) (7)

let $p = 1/2\ D$

$$C = VA_1 = \int_{ap}^{p} 4\pi^2 p^2 N \tan a \triangle p$$

$$= \frac{(1-a^3)}{6} \pi^2 N \tan a\ D^3 \quad (8)$$

$$A.H.P. = \frac{CP}{6356}$$

$$= \int_{ap}^{p} \frac{16\pi^4 N^3 \tan^3 a p^4 \triangle p}{4005^2 \times 6356}$$

$$= \frac{(1-a^5)\ \pi^4 N^3 \tan^3 a D^5}{10 \times 4005^2 \times 6356} \quad (9)$$

$$\frac{C}{A.H.P.} = \frac{5 \times 4005^2 \times 6356\ (1-a^3)}{3\pi^2 N^2 \tan^2 a\ D^2 (1-a^5)}$$

For ready comparison these formulae are tabulated side by side, thus:

	Constant-Blade Angle Disc Fans	Increased Pitch, Constant Air Velocity Propeller Fans
Air Speed (V)	$\pi DN \tan a$ (maximum)	$\pi DN \tan a$
Net Area	$\frac{\pi D^2}{4}(1-a^2)$	$\frac{\pi D^2}{4}(1-a^2)$
C.F.M. (C)	$\left(\frac{1-a^3}{6}\right)\pi^2 N \tan a D^3$	$\left(\frac{1-a^2}{4}\right)\pi^2 N \tan a D^3$
Air Horsepower (A.H.P.)	$\left(\frac{1-a^5}{10}\right)\frac{\pi^4 N^3 \tan^3 a\ D^5}{4005^2 \times 6356}$	$\left(\frac{1-a^2}{4}\right)\frac{\pi^4 N^3 \tan^3 a\ D^5}{4005^2 \times 6356}$
C/A.H.P.	$\frac{5(1-a^3)\ 4005^2 \times 6356}{3(1-a^5)\ \pi^2 N^2 \tan^2 a\ D^2}$	$\frac{4005^2 \times 6356}{\pi^2 N^2 \tan^2 a\ D^2}$

Many interesting observations may be made. The value of "a" for uniform-velocity increased-pitch propeller fans depends on the tip angle a and the maximum blade angle that can be used economically at the hub. Therefore, "a" increases as a increases for this type of fan.

In the disc fan "a" depends on tendency toward back flow and mechanical limitations of hub and shaft. Its value will increase if the fan operates against static pressure.

The C.F.M. (C) delivered, size for size and speed for speed, is greater with increased-pitch blades than with flat constant-angle blades for equal values of "a."

The C.F.M. (C) delivered per air horsepower produced is greater with the constant-pitch disc fan than with the increased pitch blading.

By far the most illuminating observation is the fact that disc fans

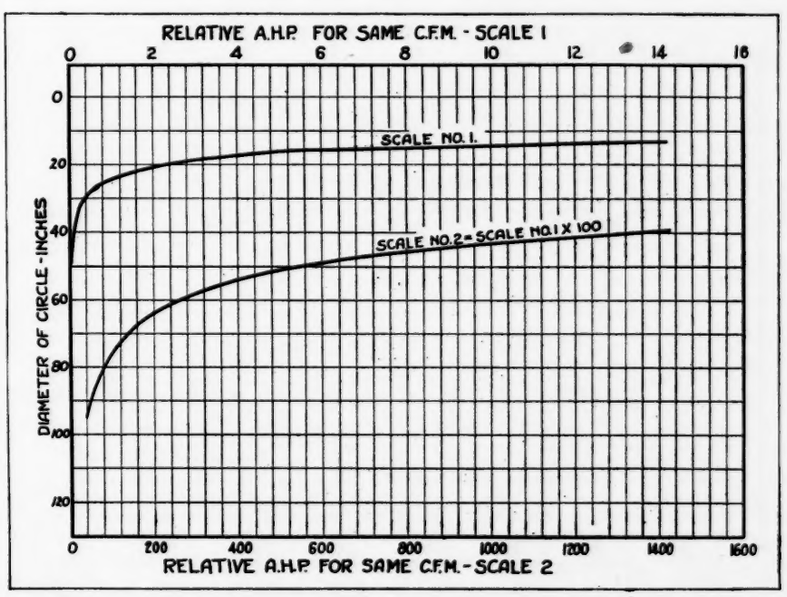


Fig. 3. Effect of Diameter on Air Horse Power

are much more efficient than is apparent from the usual method of measuring the efficiency. If we consider a test of such a fan made in a duct arranged with an exhauster so as to obtain more or less uniform air flow at zero static pressure, then we can take C as measured and compare ordinary efficiency calculations with the facts. For purposes of analysis we shall assume C as theoretically formularized. We tabulate results thus:

TABLE 2

Horsepower in the air for uniform velocity through circles with full area considered effective.

C.F.M.	Inches 12	18	24
1000	0.015901	0.0031411	0.00099385
2000	0.12721	0.025129	0.0079508
3000	0.42934	0.084808	0.026834
4000	1.0177	0.20103	0.063606
5000	1.9877	0.39264	0.12423
6000	3.4347	0.67847	0.21467
7000	5.4543	1.0774	0.3409
8000	8.1416	1.6082	0.50885
9000	11.592	2.2899	0.7245
10000	15.901	3.1411	0.99385

	Ordinary Calculations For Disc Fans	Correct Calculations For Disc Fans
C.F.M. (C)	$\left(\frac{1-a^3}{6}\right)\pi^2 N \tan a\, D^3$	$\left(\frac{1-a^3}{6}\right)\pi^2 N \tan a\, D^3$
Air Speed (V)	$\frac{C}{A_1} = \frac{4C}{\pi D^2}$	$\pi DN \tan a$ (maximum)
Air Pressure (P)	$\left(\frac{4\,(1-a^3)\,\pi N \tan a\, D}{6 \times 4005}\right)^2$	$\left(\frac{\pi\, DN \tan a}{4005}\right)^2$ maximum
A.H.P.	$\frac{16\,(1-a^3)^3\,\pi^4\,N^3 \tan^3 a\, D^5}{216 \times 4005^2 \times 6356}$	$\frac{(1-a^5)\,\pi^4\,N^3 \tan^3 a\, D^5}{10 \times 4005^2 \times 6356}$
A.H.P. when a = 0.2	$\frac{0.07231\,\pi^4 N^3 \tan^3 a\, D^5}{4005^2 \times 6356}$	$\frac{0.099968\,\pi^4\,N^3 \tan^3 a\, D^5}{4005^2 \times 6356}$
A.H.P. when a = 0.3	$\frac{0.068233\pi^4\,N^3 \tan^3 a\, D^5}{4005^2 \times 6356}$	$\frac{0.099757\,\pi^4\,N^3 \tan^3 a\, D^5}{4005^2 \times 6356}$

Of course C, as measured by test, is less than as formularized above but the formulae show that the disc fan, if credited with actual air horsepower delivered, will indicate higher efficiencies than often claimed. Allowance also should be made for blade obstruction and vena contracta.

The point of all this formularizing and discussion is to show that there are great differences in the specific performance of disc and propeller fans, and that the much-abused disc fan should be credited with more efficiency than standard tests indicate. Referring to the early part of this paper, we have shown that A.H.P. varies as the cube of the quantity delivered. Therefore, we can conclude that a fan, to deliver twice as much air as some other fan of the same size, with the same horsepower, must be eight times as efficient as the second fan. Look out for efficiencies over 100%.

We have also shown that A.H.P. varies inversely as the fourth power of the diameter. Beware of small high-speed fans for free-air service in comparison with larger lower-speed equipment.

It is interesting to observe that in disc or propeller fans delivering free air, velocity, of course, vitally affects air horsepower and, therefore, other things being equal for any given air delivery, a larger fan should be more economical than a smaller fan. The author believes that the subject of velocity-pressure deserves a great deal more attention in connection with all types of fans than generally is the case.

It is to be hoped that fan manufacturers will analyze the performances of their disc and propeller fans so that the industry will have available a sufficient number of differing designs to meet the many problems for which this general type of fan is suitable. No doubt it is evident to the reader that the use of disc or propeller fans against static pressures introduces new factors that must be considered in the design of the blading and in the relative size of the center hub of disc.

It should further be noted that the diagrams published may be useful in

TABLE 1

$$\text{A.H.P.} = \frac{576^3\, C^3}{4005^3 \pi^3\, d^4\, 6356}$$

CFM (C) Delivered—complete ring area considered effective, uniform velocity.

A.H.P.	Diameter (d)—Inches 12	18	24	30	36	42	48	54	60	66	72	84	96
0.01	856.74	1471.1	2158.9	2906.9	3706.9	4552.8	5440	6365	7325	8317.6	9341	11473	13708
0.1	1845.8	3169.4	4651.1	6262.9	7986.4	9808.7	11720	13713	15781	17920	20123	24717	29533
1.0	3976.6	6828.3	10020	13493	17206	21133	25251	29544	34000	38607	43356	53250	63627
10	8567.4	14711	21589	29069	37069	45528	54400	63650	73250	83176	93410	114730	137080
100	18458.	31694	46511	62629	79864	98087	117200	137130	157810	179200	20123	247170	295330

checking performance guarantees for fans to operate against static pressure by following these steps: First, calculate the horsepower in the air required to overcome the static pressure; then calculate the horsepower in the air from the diagram due to the necessary velocity through the wheel. Add these two together and see if the relation between the resulting total air horsepower and guaranteed brake horsepower is reasonable.

In some cases it is not necessary to consider all of the velocity-pressure, since the design of the connection between the fan and the equipment it serves may permit a change from velocity to static pressure that is fairly efficient. In such cases the total air horsepower would consist of the horsepower based on static pressure, the horsepower based on the residual velocity in the connecting duct and an allowance for the loss in conversion from velocity to static pressure.

No comment has been made in this article as to the actual or comparative efficiencies of various designs of disc and propeller fans. Accurate testing of this kind of equipment is very difficult, particularly for free air delivery, but the author believes that he has shown clearly that, size for size and speed for speed with the same motor horsepowers, a relatively small difference in rated C.F.M. means a relatively large difference in claimed efficiency. The user of this type of equipment, therefore, is cautioned to investigate the method of testing that has been used as a background for performance guarantees.

Some Points on Automatic Water Feeders

by **A. J. LOPPIN**

MANY boiler sections crack each year as a result of low water, from various primary causes, resulting in losses which can be prevented by the installation of devices to maintain the water at the proper level. It should be pointed out that experience and tests have shown that low water alone is not directly damaging; that is, does not directly cause cracking. The damage is caused by the sudden return of condensation or the introduction of fresh water on the sections.

In 1927, the question was raised by an insurance company, as to whether automatic water feeders or regulators were reliable enough to recommend their installation. There was no definite answer at hand because there were no complete performance data available, but it was recalled that there had been a number of cases where feeders had failed to function properly, had not prevented low water, and that there had even been some cases where they had actually caused damage to boilers.

A survey was made at that time to obtain a record of all the feeders that were installed on boilers insured by the company. A careful record is now being kept of the performance of each. In this connection, many of them have been opened up for cleaning and examination. Many were in need of cleaning or repairs. It was also found that in most cases very little or no attention had been given to the proper maintenance and testing of such devices. This explains to some extent why some had failed.

A careful study of the details of construction, and method of operation of various types of feeders or regulators also was made, and it was found that there were many features in some types that were objectionable. This explains to some extent another reason for some of the failures that have occurred.

During the last few years, important improvements have been made in the design and method of operation of such devices to overcome their faults.

Two distinct reasons were found for the failures that had occurred: (1) Neglect in testing and maintenance, (2) Faulty design and fabrication. The first deficiency can be overcome to a great extent by keeping a close check upon the care and maintenance. One of the things that has already been done is to send to every boiler owner an instruction circular wherein it is specified how to take care of such devices. This has resulted in fewer failures. The second deficiency is being overcome by the manufacturers by improvements in design and fabrication.

One of the most important improved features of the latest type of feeder or regulator is the isolation of the water inlet valve from the float chamber. This arrangement prevents scale from forming in and clogging the float chamber and parts therein.

In some design also the water inlet valve is arranged far enough away from the float chamber to provide for radiation and insulation to keep the temperature at a minimum and below that at which carbonate scale will deposit. The construction of floats has been improved by making them larger and of heavier material and fabricating them more carefully, so that it is unusual now to hear of any failures of the latest type float. In addition the arrangement is usually such that even if a float did fail it would merely result in the water valve remaining open and flooding the boiler. Another improved feature is the use of non-corrosive material for bearings, spindles, pins and valve parts.

Some Water Feeders Should be Used Only as Protectors

Most insurance companies agree that a device of this kind should only be used as a protector. That is, it should be set at a level where it will be called upon to function in an emergency, instead of feeding in fresh water with every slight variation in water level, since the latter results in another type of trouble with the boiler when the water contains scale-forming ingredients. When a feeder is set at the low level it is only semi-automatic in action, that is, the water in the boiler has to be restored to the normal level by manual manipulation of the by-pass feed valve. This semi-automatic feature makes it necessary to ascer-

tain the cause of the low water and eliminate it before normal operation can be resumed.

It is felt that there is justification for recommending or approving the use of protectors or feeders, provided the following conditions are met:

(1) That the device is an approved type, that is, possessing all the following features as minimum requirements:

(a) Water inlet valve separate from float chamber.

(b) Bearings and pins of non-corrosive material.

(c) Water valve parts and spindles of non-corrosive material.

(d) All parts readily dismountable.

(2) That it be of adequate capacity.

(3) That it will be properly maintained and tested, as prescribed in the instruction circular.

It is recommended that adequate strainers be installed to keep out foreign matter.

Systems in which pumps are used are more likely to have low water in boilers than gravity return systems because pumps are subject to stoppage from various causes, and therefore approved protectors or feeders are particularly desirable for all cast-iron sectional boilers operating on pump systems. Some companies refuse to insure boilers on pump systems unless there is a feeder.

Feeders Recommended for Both Gravity and Pump Systems

They are also recommended for gravity systems with which trouble has been experienced, and are recommended for boilers, whether on gravity or pump systems, in garages, churches, schools and hotels, where there are no experienced attendants who spend a reasonable amount of time in the boiler room.

Above all, stress should be laid upon the importance of not relaxing vigilance after a protector or feeder has been installed. It should be made clear that it is not a *substitute* for manual attention but that it is an *additional* protection.

It should also be understood that protectors will not prevent *all* cracking of sections but should prevent those attributed to low water.

Instructions for Water Feeder Testing and Maintaining

An automatic water feeder is a device that is intended to let in fresh water automatically whenever the water in a boiler gets below a predetermined level, and thereby prevent damage.

It is highly important that such devices be tested regularly, at least weekly, in order to make sure they are in good working order.

Tests can be made by letting out the water to a point below the level where the device is set to operate and noting whether the device responds and supplies fresh water.

Also it is important that each device of this kind, particularly older types where the fresh water is let in through the float chamber, be provided with a blow-off arrangement for removing all deposits that may accumulate in the float chamber. Blowing off through this connection also affords a test, for as the water lowers it should cause the feed valve to open.

In addition, it is advisable that complete reliance be not placed upon the device, but that the water level be observed frequently during the day, when the boiler is in service.

Furthermore, it is strongly recommended that at the end of each summer before the heating season, the float chamber be opened up to see whether there are any deposits that need to be cleaned out and whether the moving parts work freely, are clear and are not corroded or stuck. In many cases some of the older types of feeders have been found to be badly choked up with deposits and parts corroded. In some of the newer types opening frequently this may not be necessary or advisable, but there must be a limit for every device no matter how perfect the manufacturer may claim it to be. Water is a very destructive agent under certain conditions.

Unless a device of this nature is carefully maintained and checked up too much is being expected of it. It should be considered as an *additional protection* and not as a *substitute* for careful manual attendance and supervision. It is not a device that can be put upon a boiler, forgotten and expected to keep in good working order for an indefinite unlimited period. On the other hand, when properly taken care of as suggested, they can, in general, be relied upon to operate in an emergency, which is their special function.

Reliable manufacturers of such devices recommend these precautions.

Effect of Radiant Energy on Skin Temperature Being Studied

The United States Public Health Service in conducting studies relating to industrial hygiene has recently completed a report dealing with the effect of radiant energy on skin temperature. This report describes the instruments that were devised and employed in these studies to determine radiant energy and skin temperature. A general picture of the results obtained has also been given as an indication or sample of the relationship between skin temperature, radiant energy, and the atmospheric conditions among steel workers. The final comparisons have been left to a later monograph which will show what correlations may appear between conditions found and the sickness rates, primarily pneumonia.

The following points have come out rather clearly in this preliminary analysis:

1. Intense sources of radiant energy had a pronounced effect on the skin temperatures of workers exposed to them; the forehead and cheeks showed the greatest increase.

2. Great differences in the skin temperatures of different parts of the body, for a single individual, were found in workers exposed to radiant energy.

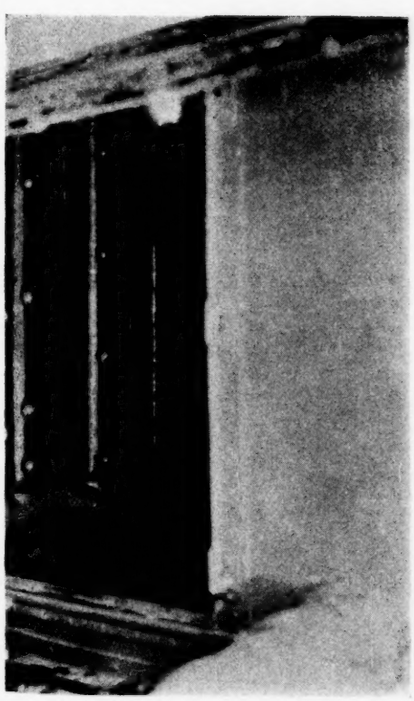
3. Even under relatively cold atmospheric conditions, not far above the freezing point, high skin temperatures were encountered in workers exposed to radiant energy.

4. For workers not exposed to radiant energy there was a definite relation between atmospheric conditions and skin temperatures, both for arduous and for moderate work; the skin temperatures increasing with increase of effective temperature.

Chateau Laurier Hotel, Ottawa, Canada

Air Conditioning Equipment for the Chateau Laurier

by **DR. PETER H. BRYCE**



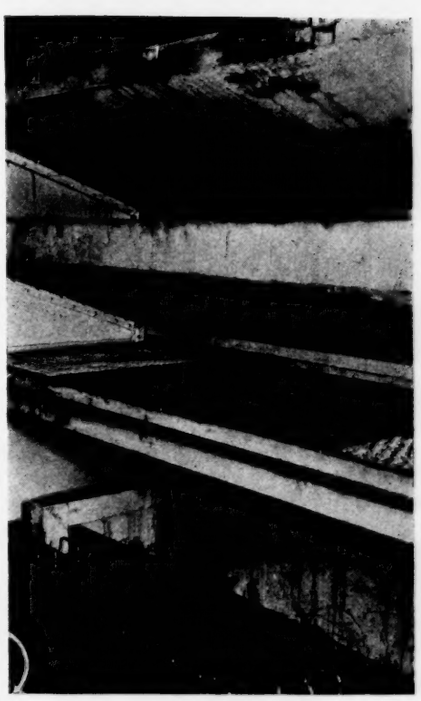
Air Cooling Unit in Chateau Laurier Hotel

Spray from the vertical pipes collects in horizontal pan which overflows into a lower pan containing a brine pipe. The amount of cooling of the water is regulated by a thermostat.

ON the cliff overlooking the Ottawa River, in Ottawa, Canada, at a point where the central Rideau Canal descends to the river by a series of seven locks, built one hundred years ago out of cut limestone blocks by English engineers, stands the Chateau Laurier. To the south across Connaught Place is the railway terminal station of Grecian design, controlled by the Canadian National Railways. To the west is Parliament Hill with its splendid new Gothic buildings, modelled by nineteenth century architects.

Through the good taste and wisdom of the present premier, an admirer of Laurier ideals, the area of the Place has been doubled by the purchase and removal of old buildings, and the enlarging of the capital's centre to an extent in keeping with the future of the "Dominion of the North."

The architects doubtless consulted Sir Wilfrid Laurier in the choice of the French castellated type of chateau, as fitted to the location in Major's



One of the Air Filter Units, Chateau Laurier Hotel

Air enters the filter from an adjoining room connecting with the airshaft.

Hill Park. Behind the chateau, to the north, one can gaze at the Falls of the Chaudiere to the west and the far Laurentians.

A central heating plant on the grounds of the Canadian National Railways supplies steam to the Chateau Laurier, as well as to the railway station. Steam mains extend several hundred yards from the station to the hotel, through a large underground tunnel across Sparks Street, alongside a passenger subway extending from the station to the train.

Conveniently located in the basement of the hotel is the engineer's office with its gauges, telephones, temperature control equipment and electrically-driven ice machines. Temperature gauges in the engine room indicate the temperature of the tea room, ball room, restaurant and other public rooms, while other gauges indicate the steam pressure at different points.

Speaking generally, the system of heating is a combined one, with radiators in the bedrooms and in certain other rooms, while a system of plenum and exhaust fans handle the air for the larger rooms, such as restaurants, tea room and ball rooms. One fan system supplies air to the grill room, cafeteria and dining room, while another system handles the main dining room, service room and palm room.

To supply these fan systems, a central heating chamber is provided which brings in the outer air from a point 100 ft. above the street, and filters it by passing the air through a series of grated shelves on the bottom of which is a series of wire-lath meshes laid over one another to a depth of 2½ in. These meshes are flooded in an ingenious manner with an odorless Great West Bescosine oil on which the dust and coal grit from the smoky air are deposited. After passing through the filters the air is warmed by Vento heaters.

In summer the air is cooled by an arrangement comprising a chamber 20 ft. square equipped with an upper and lower pan. These pans are supplied with water sprayed from vertical pipes. The upper pan receives water at the ordinary temperature. When the pan becomes filled, the water overflows to a lower pan containing pipes through which brine from the ice machine circulates. By means of a clever device the pump which supplies the spray also can direct the current of the water (which is recirculated) into the upper or lower pan by a thermostat control.

In a typical test of the cooling system, made on a summer's day, the outer air entering the chamber registered 80° F., while the temperature of the air delivered to the grill room was 64° F. On a particularly hot day, when the outdoor temperature was 94° F., the grill room temperature was held to 73° F.

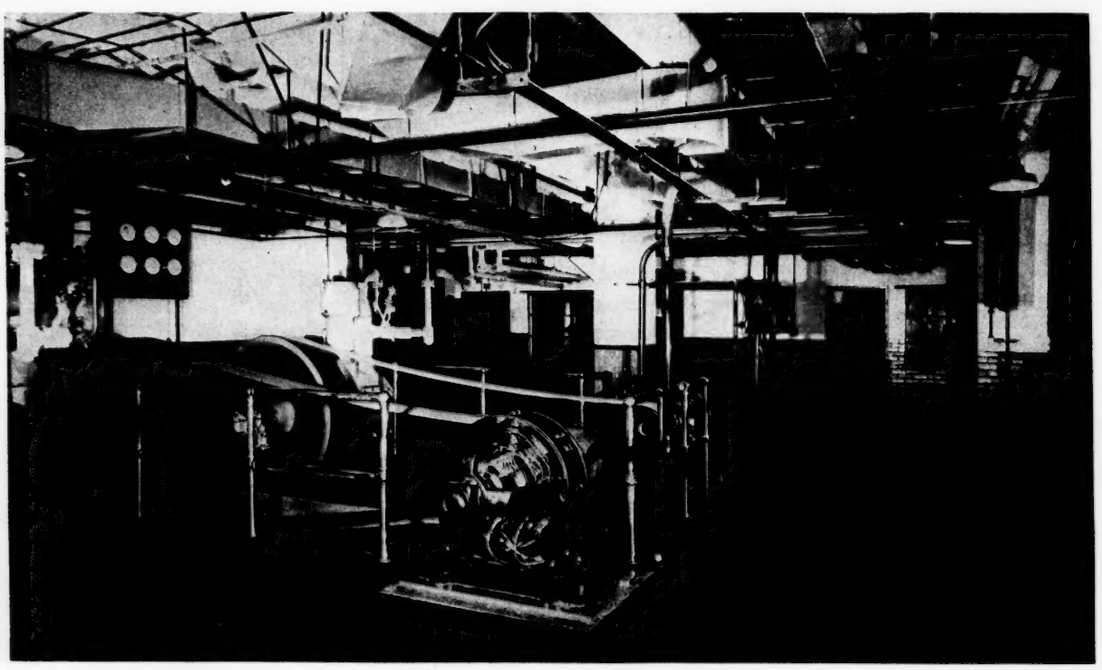
The architects of the Chateau Laurier are John Archibald, of Montreal, and John Schofield, of the Canadian National Railways. Wilson and Kearns, of Montreal, are the consulting engineers and John Colford, of Montreal, the contractor for the heating and ventilating equipment.

Wisconsin Offers Advanced Extension Courses

The University of Wisconsin Extension Division is offering an advanced course in heating and ventilating, to be given at its Milwaukee branch, 619 State Street, on Tuesday evenings, beginning September 23. This instruction, in charge of Professor C. L. Dean, is designed to give opportunity for study and informal discussion of modern methods of design and installation, and for analyzing recent developments in this important field.

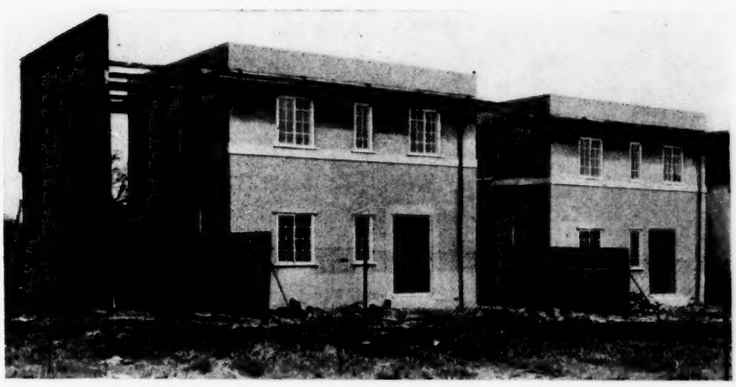
A few of the many topics to be taken up are: Heat Loss from Buildings; Infiltration and Methods of Calculation; Coefficients of Heat Transmission and Exposure Factor; Advantages, Disadvantages, and Comparative Value of Different Methods of Heating; Warm Air and Hot Water Heat; Plans and Specifications.

This course may be taken only by men with a good understanding of both the fundamental principles and the practical aspects of heating and ventilating.



Ammonia Compressor Room at the Chateau Laurier Hotel, Ottawa, Canada

British Tests Prove Heat Economy of Thatchboard Houses



Two Houses Employed in Testing Insulating Properties of Thatchboard. The House on the Left is of Ordinary Brick Construction, and that on the Right of Thatchboard

FOR several months past the British Department of Scientific and Industrial Research has been engaged at the Building Research Station, Watford, upon a thorough investigation of the heat requirements of a thatchboard house, and it has just issued its report on the subject. The object of the investigation is the comparison under varying weather conditions of the heat requirements of a house incorporating thatchboard with those of a similar house of standard brick construction.

The test was carried out on two houses erected at Garston, Watford, very close to the Building Research Station. The houses were heated electrically, keeping the temperature of corresponding rooms equal by thermostatic control. The heat requirement of each house was then given by the consumption of electric energy in that house.

The houses are small flat-roofed six-room cottages of a cubical shape identical in size and plan but differing in constructional details. The standard house is of normal construction with 9-in. external brick walls rough-cast on the outside and plastered on the inside. The north wall of the thatchboard house is of 4½-in. brick lined with 2-in. thatchboard; the south wall consists of 4-in. of concrete lined with 2-in. of thatchboard. The east and west walls are of 2-in. thatchboard, the east wall being divided into two by the brick chimney stack serving the living room, parlor, and two of the bedrooms. All outside walls are rough-cast without and plastered within. The internal partition walls consist of a single layer of thatchboard plastered. A single layer of thatchboard is laid below the flooring boards and another above the ceilings of the ground floor rooms. A double layer, separated by an air space, covers the whole of the roof. The houses were erected at a similar cost.

Since the thatchboard house was screened from wind, sun and rain by the standard house on the west side and by another cottage on the east side, a thatchboard screen was erected on the west side of the standard house to attempt to equalize weather conditions over the two houses.

Heating was by thirty tubular electric heaters and each room, including the halls, was controlled by a thermostat. The thermostats were previously calibrated at the Building Research Station by a laboratory experiment. They were paired as to characteristics and installed so that one of a pair was in the standard house while its companion controlled the corresponding room of the thatchboard house. Two meters were installed in each house, a main meter recording the total consumption and an auxiliary meter giving the consumption of the living room alone. During the test period the hall, kitchen, and bedrooms of each house were kept at 55° F. and the living room and parlor at 60° F. Meter readings were taken at 9;30 a. m. each day.

Heating was commenced on February 8 and continued to April 30, 1930. During the period February 8 to 20 the windows were kept open so that the buildings might dry out.

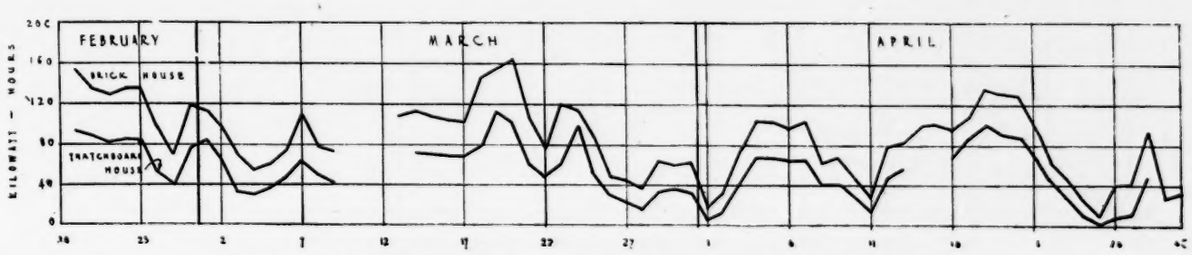


Fig. 1. Total Energy Consumptions. February 20 to April 30, 1930

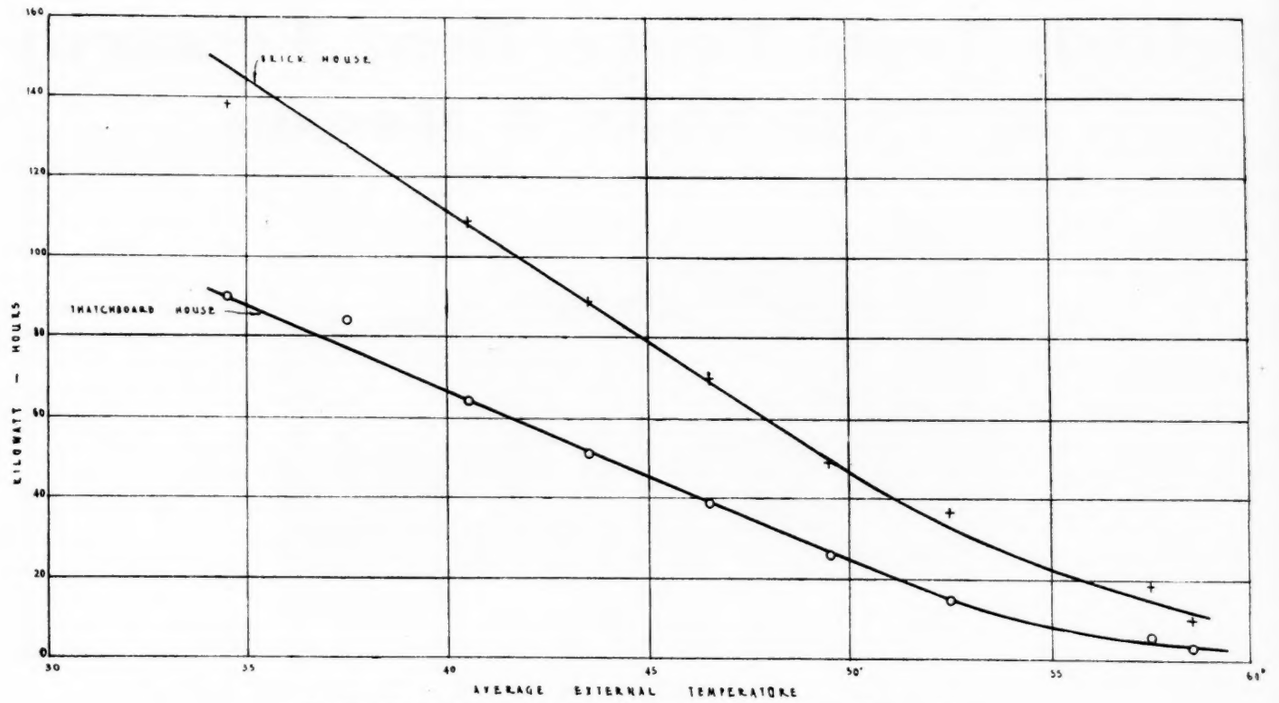


Fig. 2. Total Energy Consumptions Against External Temperature

After February 20 they were closed and except for one or two days on which alterations were being carried out the readings may be taken as being reliable.

Figs. 1, 2, and 3 show the results of the test in graphical form. Fig. 1 shows the units of electricity consumed by each house for every day during the test period. Figs. 2 and 3 give the requirements of the whole house and living room respectively plotted against averaged outdoor shade temperature. Since other weather variables (wind, sun and rain) affect the consumption, the individual points if recorded separately would be scattered somewhat widely about the mean curve. Therefore in plotting Figs. 2 and 3 the temperature range was divided up into 3° intervals (except in the case of the last two points), the daily consumptions in each interval were averaged and the average plotted against the temperature at the midpoint of the interval.

Energy required by the thatchboard house was consistently less than that taken by the standard brick house. The total consumptions of the two houses over the period February 20 to April 30 (excluding ten days when alterations were being carried out) were 3,342.8 kw. hr. for the thatchboard house and 5,397.9

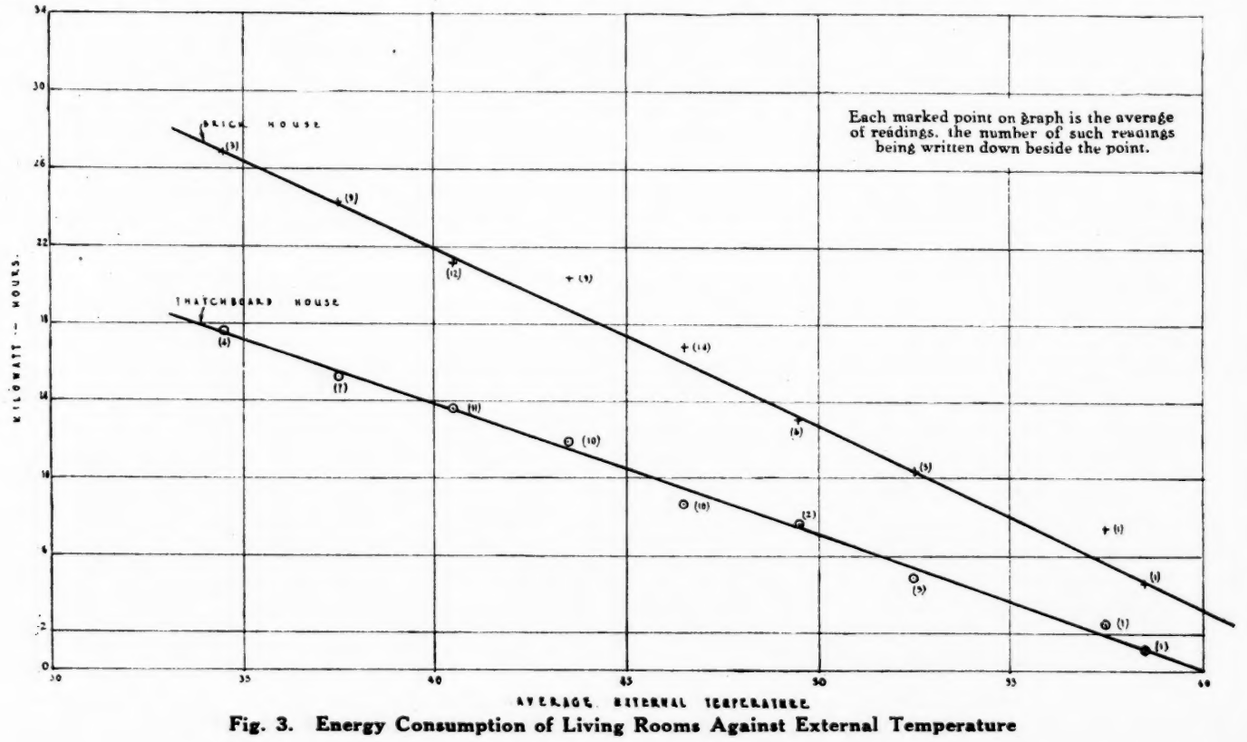

Each marked point on graph is the average of readings, the number of such readings being written down beside the point.
BRICK HOUSE
THATCHBOARD HOUSE
KILOWATT - HOURS
AVERAGE EXTERNAL TEMPERATURE

Fig. 3. Energy Consumption of Living Rooms Against External Temperature

kw. hr. for the brick house. This means that to keep the thatchboard dwelling at the specified temperatures of 60° and 55°, 62% of the heat to maintain those temperatures in the standard house was required.

Results prove that a definite economy in fuel consumption results from the employment of thatchboard as a walling material, and that this economy may be expected to amount to 35% to 40% of the heat requirements of a similar brick house.

Heating and Ventilating the Empire State Building

Continued from Page 65

tanks at the vacuum pumps.

Hot condensate from the vacuum pumps will discharge through two heat exchangers through which the service water for hot water for the building is run ahead of and in series with two of the hot water generators. In this condensate line beyond the heat exchangers there will be an automatic mixing valve for further cooling the condensate before it enters the sewer.

There will be a control panel in the sub-basement, from which, by means of pneumatically operated switches, valves on the steam mains on the sub-basement, 29th and 54th floors can be opened or closed. The mains and valves on each of these floors are so arranged that there will be one pneumatically operated valve controlling the radiation on the east and south walls of a vertical zone and another controlling the radiation on the west and north walls of each zone.

The five entrances on the first floor will be heated by means of a recirculating hot blast system. There will be a separate fan for each entrance that will draw the air from the ceiling of the entrance corridor and, after passing it over, tempering stacks discharge it into the entrance vestibules and corridors through registers near the floor. Three rows of these stacks are under remote manually-operated control, and two rows under thermostatic control with the thermostat located at the fan intake. Provision has been made to take the air from outdoors instead of from the corridors in case it is found desirable to create a pressure in the entrances to counteract the natural indraft.

Hung ceiling space under the sixth floor setback is provided with pipe coils, controlled from an accessible position, to counteract the cooling effect of the roof above. Some of these coils under that setback are shown on the quarter plan of this floor.

Is the American Home Owner Modernization Conscious?

Modernization today, more than at any period in the heating industry, is the gateway to increased and more profitable business. For the past ten years, manufacturers of products for home use have been spending literally billions of dollars in newspaper and magazine advertising, radio, direct mail campaigns, consumer demonstrations, pamphlets and literature, to stimulate a public interest in modernization in its broadest sense. That they have succeeded is evidenced in the wide use, and present commonplace character of the many aids to home comfort, convenience and beautification, which but a short time ago were considered luxuries.

Nearly every large daily and weekly now features a modernization or building page in which editorials further stress the advantages of modernizing the home.

Heating and heating equipment, being an integral part of home life, and a vital factor in the health, comfort and happiness of the home, play an important role in both magazines and newspapers. Recognizing the service that could be thus rendered to the entire heating industry, and incidentally the demand for authoritative material, such organizations as the Plmbing and Heating Industries Bureau; the Modernization Bureau; the publicity divisions of heating manufacturers, constantly supply editors with timely illustrated articles for their modernization pages.

It is said in many quarters that this persistent and valuable nation-wide publicity is not only breaking down sales resistance for the heating contractor, but that viewed in the light of these articles, his life work is assuming new significance and prestige in the eyes of the home-owner. It may here be recorded that the magazine and newspaper sponsored publicity accorded the heating trade is available to few other industries. From this viewpoint the heating contractor is in an enviable position.

When we remember that the accumulated effect of this vast educational campaign, which is rapidly becoming more intensified, is crystallized and focussed on present conditions, it may be stated that 1930 presents an unprecedented opportunity for the heating industry in the modernization field. The market is almost unlimited, being represented, according to the latest U. S. Chamber of Commerce figures, by the 16 million homes which do not yet enjoy radiator heat.

Considering the complicated and intricate system of living in the average American city it is no wonder that today, without exception, products are sold—not bought. So many luxuries are clamoring for attention that often the vital problem of modernizing the home with a modern radiator heating plant is overlooked. Life insurance underwriters do not receive calls for policies, yet it is common knowledge that approximately thirteen billion dollars in life insurance was sold in 1929. Backed by nation-wide publicity, it would seem that the most profitable road to increased modernization business is down the Avenue of "personal contact."

Semi-Annual Report of Plumbing & Heating Industries Bureau

In the semi-annual report of the Plumbing and Heating Industries Bureau, recently published, the accomplishments of this organization during the past six months are outlined.

The bureau reports that on July 1, 1930 the cash on hand amounted to $30,139.27. The newspaper publicity campaign organized in January of this year has steadily increased its activities and now serves 203 newspapers, reaching over thirteen million readers. Great success has been met with the bureau's new bulletin, now published in the form of a sales manual. Exclusive of special requests, about 18,000 copies of this bulletin are mailed each month.

Many helpful suggestions have been offered by the bureau to contractors regarding bookkeeping systems, sales helps and mechanical education. Regional management conferences have been held in principal cities all over the country and have contributed many helpful hints on salesmanship.

In cooperation with the National Pipe and Supplies Association, the bureau is making a field study at the present time on the following subjects:

1. What selling and management aid is the contractor receiving from the wholesalers' salesmen?

2. What steps are necessary to develop the wholesalers' salesmen into effective aids to the contractor?

3. What internal procedure is needed to effectively control the selling and promotional activities of wholesalers' salesmen?

Demonstration Test of Underground Steam Pipe Conduit

One of the interesting exhibits at the recent International Heating and Ventilating Exposition, in Philadelphia last January, was a testing equipment for determining the efficiency and durability of Ric-wiL steam pipe conduit and insulation.

Included in the exhibit was a line of conduit undergoing a condensation test. This line comprised a 3-in. steam pipe run in 10-in. Type F conduit. Steam was supplied at 60 lbs. gauge pressure and the test apparatus was so arranged that it was possible to observe how the condensation collected at the other end of the line and was weighed on a small scale resting on the floor.

In this same line of conduit, thermometer wells were placed so that the temperatures registered by the thermometers showed the proportional temperature drop through 1-in., 2-in. and 3-in. thicknesses of Ric-wiL Dry-paC filler. A thermometer well also was placed on the steam pipe so that the temperature drop for the different thicknesses of Dry-paC could be compared with the steam temperature.

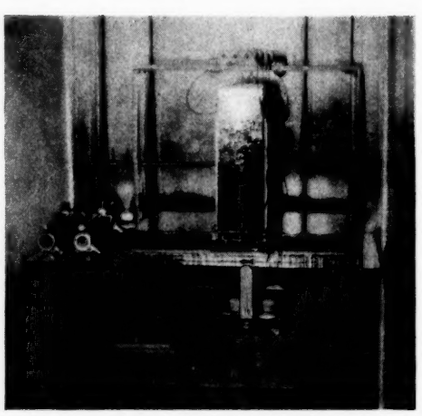
With a steam temperature of 260° F. at approximately 20 lbs. gauge pressure the temperature of a 1-in. thickness of Dry-paC was 104° F. With a 2-in. thickness the temperature was 89° and with a 3-in. thickness, 83° F. During the period of the test the room temperature was approximately 78° F.

By means of pet-cocks slightly opened on the 3-in. steam line, the effect of an actual steam leak was shown, first on No. 1 Ric-wiL filler, which is an ordinary non-treated asbestos filler, and, second, on Dry-paC waterproof filler. After two days of operation, the ordinary No. 1 filler was completely saturated above the steam leak, whereas the Dry-paC was only slightly damp on top where the condensation had gathered, the filler underneath this top layer remaining dry.

Another feature of the exhibit was a hot-plate instrument for measuring the conductivity of a sample of Dry-paC filler.

By means of two glass tubes immersed in water, the effective waterproofness of Dry-paC was further illustrated. One tube was filled with ordinary asbestos filler which asborbed the water to the extent of about one-quarter the height of the tube. The other tube was packed with Dry-paC at the same density but showed no signs of water absorption.

To determine whether Dry-paC will settle under vibration, a 5-ft. section of 2-in. pipe was installed in an 8-in. Type F conduit packed with Dry-paC filler, the joints on the conduit being cemented. On one end of this pipe was placed an electric motor with an eccentric bearing against the pipe. On the other end of the pipe was attached a light coil spring which, in turn, was fastened to a buffer block. This apparatus transmitted 1200 vibrations per minute to the pipe. During the period of the exhibit, under this severe condition, no settlement took place in the Dry-paC. Observation holes were cut through the top half of the conduit so that any settlement could easily be noticed.



Hot Plate Apparatus for Measuring Conductivity of Conduit Filler

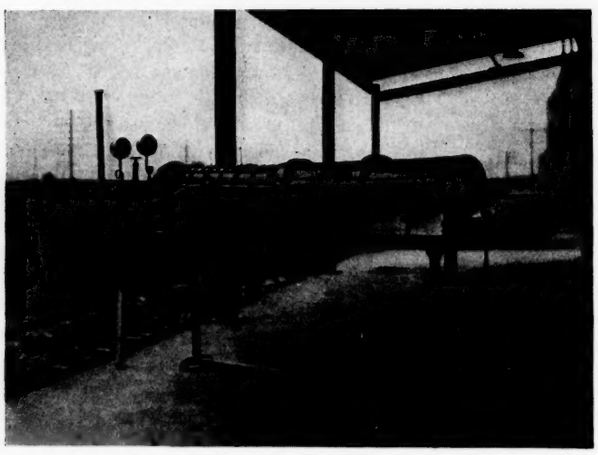
Model of Air-Conditioned Capitol for World's Fair

An exhibit showing a cross section of the Senate Chamber in the Capitol at Washington illustrating the way in which that hall is cooled, heated and ventilated, has been proposed for the Chicago World's Fair in 1933 as part of display showing the development of refrigeration as a science during the past hundred years.

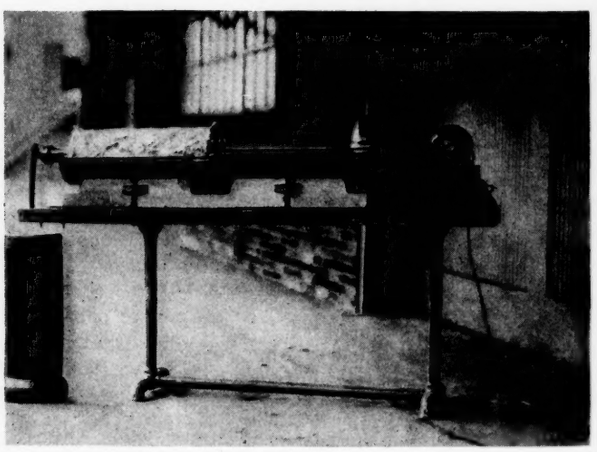
The proposal is contained in a report of the mechanical engineering section of the National Research Council Science Advisory Committee under whose direction all the mechanical engineering exhibits will be staged at the exposition. The National Research Council Science Advisory Committee is composed of about 40 leaders in all branches of American scientific achievement who, under the chairmanship of Dr. Frank B. Jewett, president of the Bell Telephone Laboratories, are developing plans to make the science display the main feature of the Chicago fair.

Pattern Drafting for Sheet Metal Shops

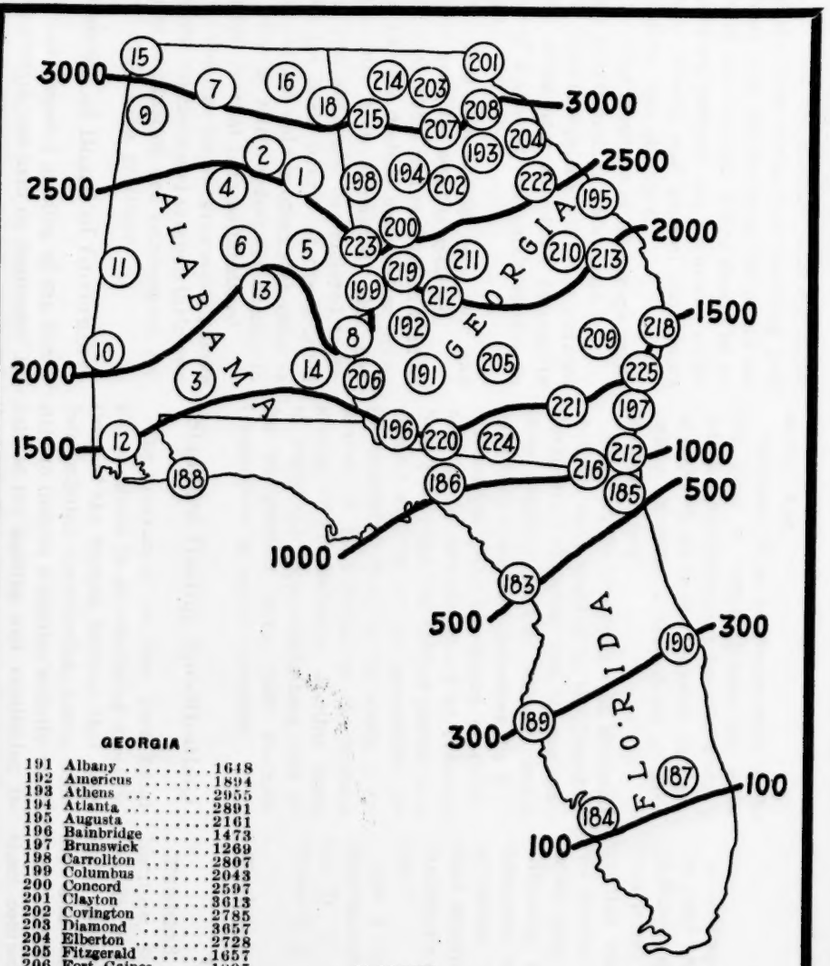
"Fundamentals of Pattern Drafting for Sheet Metal Shops" is the title of a 32-page booklet published by the Sheet Metal Shop Service Bureau of the Armco Distributors Association of America, Middletown, Ohio, which will supply the booklet free. Twelve lessons are included, among which are patterns for a 90° elbow, T-joint, pipe intersections at an angle, irregular intersections, roof flanges, Y-branch, square return miters, etc. The purpose of the book is to supply the groundwork so that the student can more easily follow the various textbooks available on the subject.



Condensation and Conductivity Test Set-Up for Pipe Conduit and Insulation



Vibration Test to Determine Extent of Settlement of Filler



GEORGIA

191	Albany	1648
192	Americus	1894
193	Athens	2955
194	Atlanta	2891
195	Augusta	2161
196	Bainbridge	1473
197	Brunswick	1269
198	Carrollton	2807
199	Columbus	2043
200	Concord	2597
201	Clayton	3613
202	Covington	2785
203	Diamond	3657
204	Elberton	2728
205	Fitzgerald	1657
206	Fort Gaines	1807
207	Gainesville	3213
208	Gillsville	2806
209	Glenville	1623
210	Harrison	2183
211	Macon	2203
212	Marshallville	2016
213	Millen	1967
214	Ramhurst	3216
215	Rome	3067
216	St. George	1198
217	St. Mary's	1187
218	Savannah	1490
219	Talbotton	2257
220	Thomasville	1400
221	Waycross	1470
222	Washington	2653
223	West Point	2658
224	Valdosta	1308
225	Valona	1485

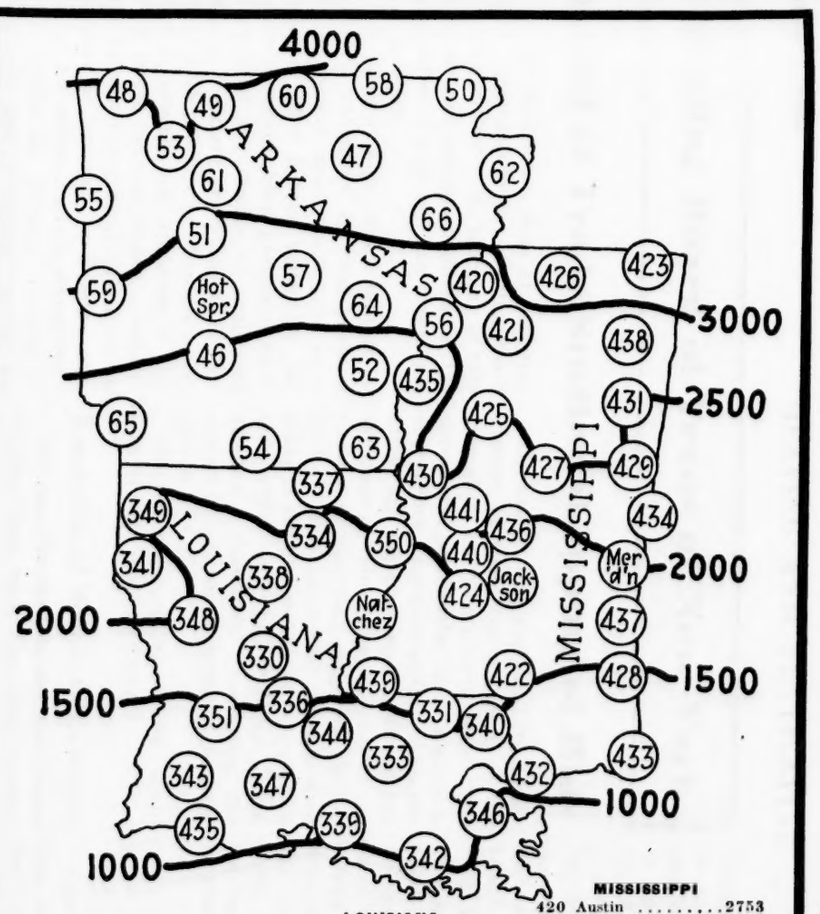
ALABAMA

1	Anniston	2813
2	Ashville	2881
3	Bermuda	1817
4	Birmingham	2408
5	Camp Hill	2251
6	Clanton	2408
7	Decatur	3126
8	Eufaula	2147
9	Hamilton	2764
10	Healing Springs	2257
11	Livingston	2371
12	Mobile	1471
13	Montgomery	1886
14	Ozark	1735
15	Riverton	3396
16	Scottsboro	3153
17	Tuscaloosa	2529
18	Valley Head	3218

FLORIDA

183	Cedar Keys	641
184	Fort Myers	122
185	Jacksonville	890
186	Monticello	1129
187	Okeechobee	91
188	Pensacola	1448
189	Tampa	296
190	Titusville	345

ISO-DEGREE-DAY CHARTS—Alabama, Florida and Georgia | No. 5-R New Series



ARKANSAS

46	Arkadelphia	2511
47	Batesville	3430
48	Bentonville	3949
49	Bergman	3956
50	Corning	3681
51	Dardanelle	3012
52	Dumas	2803
53	Dutton	4167
54	El Dorado	2301
55	Fort Smith	3214
56	Helena	2764
	Hot Springs	2625
57	Little Rock	2811
58	Mammoth Springs	3735
59	Mena	3006
60	Mountain Home	3538
61	Okay	3440
62	Osceola	3152
63	Portland	2183
64	Stuttgart	2776
65	Texarkana	2216
66	Wynne	3070

LOUISIANA

330	Alexandria	1747
331	Amite	1494
332	Antioch	2157
333	Baton Rouge	1349
334	Calhoun	2169
335	Cameron	1285
336	Cheneyville	1606
337	Collinston	1997
338	Dodson	1726
339	Franklin	1188
340	Franklinton	1489
341	Grand Cane	2099
342	Houma	1078
343	Lake Charles	1396
344	Melville	1431
345	Natchez	1668
346	New Orleans	1023
347	Rayne	1267
348	Robeline	1996
349	Shreveport	1938
350	Tallulah	2057
351	Tenmile	1454
352	Vicksburg	1809

MISSISSIPPI

420	Austin	2753
421	Batesville	2904
422	Columbia	1740
423	Corinth	3411
424	Crystal Springs	2010
425	Greenwood	2390
426	Holly Springs	3308
	Jackson	1959
427	Kosciusko	2480
428	Leakesville	1302
429	Macon	2507
	Meridian	2294
	Natchez	1670
430	Nitta Yuma	2649
431	Palo Alto	2524
432	Pearlington	1331
433	Pecan	1565
434	Porterville	2104
435	Rosedale	2344
436	Shoccoe	1932
437	Shubuta	2133
438	Tupelo	2780
439	Woodville	1565
440	Vicksburg	1822
441	Yazoo City	2152

ISO-DEGREE-DAY CHARTS—Arkansas, Louisiana and Mississippi | No. 5-S New Series

Heating and Ventilating's Data Sheets Nos. 5-R and 5-S

Heating Board of Trade of New York

Board of Trade Studies Shopping of Bids

In the September issue of "Heating News," published by the Heating Board of Trade of New York, shopping of bids is defined and recommendations for the elimination of this evil are made. Abstracts follow:

"Shopping of Bids" in the heating industry is understood to mean pressure by the vendee upon the vendor or a voluntary offer by the vendor to the vendee to reduce prices previously quoted, without any change of equivalent value in the goods or services to be supplied. Such pressure or offers are recognized as arising from members of any group of the heating industry, namely, from an owner or general contractor, an engineer or architect, a heating contractor, his sub-contractors, manufacturers or agents and jobbers. It must be recognized that "shopping" is not an individual operation, but necessarily involves both a purchaser and one seller (or more, usually several), either of whom may be a member of any one of these groups.

Recommendations

The Heating Board of Trade of New York recommends as follows:

1. That the engineer and contractor refrain from inviting or receiving proposals from one to whom he would not award the contract. There should be cooperation between the engineers, architects, owners, and general contractors to attain this objective.
2. That members of all groups quote their lowest price the first time.
3. That this price shall not be reduced after being once submitted (except in case of a general and public change in costs).
4. That this should be a fair and proper price for what is specified.
5. That where real changes in kind or quantity are decided upon (after prices have once been submitted) this new condition shall not be employed to reduce the basic figures of the original proposal, but only to effect such changes in price as fairly reflect the change in the cost of what is to be furnished.
6. That the various groups study these recommendations and through their own means of adoption and enforcement, improve their sales practices.

Meeting of Board of Governors

A well attended meeting of the Board of Governors was held on September 11, 1930.

The subject that engrossed the larger amount of time was a report of the Committee on "Shopping of Bids." The debate was participated in by engineers, contractors, sub-contractors, manufacturers and jobbers, which permitted the exchange of views from the angle of the various groups that make up the industry. Some desirable changes were made in the phraseology of the committee's report, following which the board adopted a resolution transmitting the subject to a general meeting of the association.

The resolution referring to the shopping of bids reads as follows:

Resolution of Board of Governors

Whereas, The Heating Board of Trade of New York recognizes with concern the almost universal practice of all groups of the industry making a first price for services and commodities, and then trading on this in an attempt to secure the business, this resulting in selling on a price basis rather than on the value of the service or commodity commensurate with high grade workmanship and superior material and equipment in accord with accepted standards. And,

Whereas, Of no less importance is the low level to which prices are being driven with consequent financial distress to many or all in the industry, this procedure effecting a breakdown of good business. And,

Whereas, The Committee on Shopping of Bids has presented to the Board of Governors a statement and recommendations relating to this subject, which have been accepted. Therefore, be it

Resolved, That the Board of Governors of the Heating Board of Trade of New York refer this subject matter to a general meeting of the association for its consideration, following which, if approved, it be referred to the various groups of the industry, inviting them to study the recommendations, and as far as possible bring their business transactions in accord therewith.

Standard Heating Specifications

The program of the New York Building Congress in standardizing specifications of the various features that enter into building construction, seems definitely to include a similar activity in behalf of the heating and ventilating industry. Some time ago, the congress through W. A. Payne, chairman of its Standards Committee, requested the Heating Board of Trade of New York to play an important part in the drafting of this document. Werner Nygren, president of the board, conferred with Mr. Payne, and the outcome has been acceptance by the former of the assignment of preparing the first draft of these specifications. When this initial step has been accomplished, it will be reported to a specialized committee who will be asked to review the results. It is anticipated that after passing through these various stages, with the benefit of advice from experts drawn from the different branches of the industry, that the congress will endorse the specifications, following which it is hoped the standards will come into general employment by architects and engineers.

Heating Engineers on Power Show Board

Under the leadership of I. E. Moultrop, chairman, preliminary details of the Ninth National Exposition of Power and Mechanical Engineering, to be held in Grand Central Palace, New York, December 1-6, are well under way.

Included on the Advisory Committee are Homer Addams, past-president of the A.S.H.V.E.; L. A. Harding, president of the A.S.H.V.E.; O. P. Hood, chief mechanical engineer, U. S. Bureau of Mines; David Moffatt Myers, consulting engineer, and others.

Coal in 1928

A 183-page bulletin on coal, covering the year 1928, has been published by the Bureau of Mines of the United States Department of Commerce. The book contains statistical summaries, tables and graphs covering production, distribution and consumption data for the anthracite, bituminous coal and lignite industries. Automatic heating is treated, anthracite in particular being given some attention in the chapter entitled "Anthracite's Effort to Meet Competition."

Size 6 in. x 9 in. For sale by the Superintendent of Documents, Washington, D. C. Price 30c. Authors, F. G. Tryon, O. E. Kiessling and L. Mann.

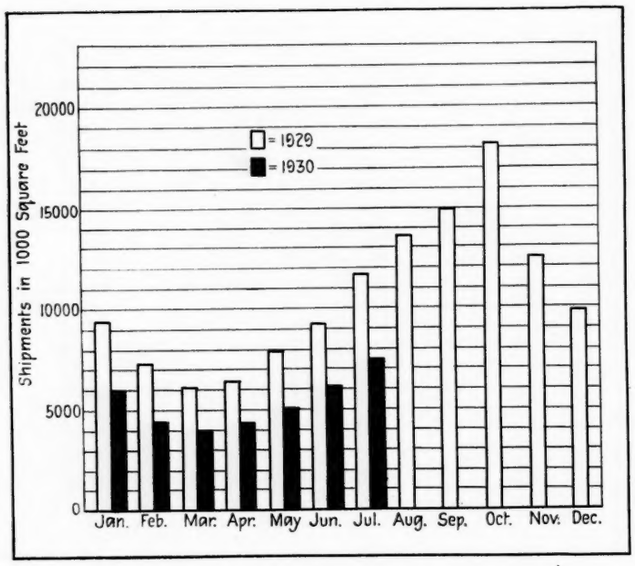
Training for Bigger and Better Opportunities

Published by the St. Louis Technical Institute, St. Louis, Mo., this booklet contains a directory of courses on sheet metal design, pattern drafting and heating and ventilating engineering for home study. Information on special short courses in these subjects is also included.

HEATING AND VENTILATING

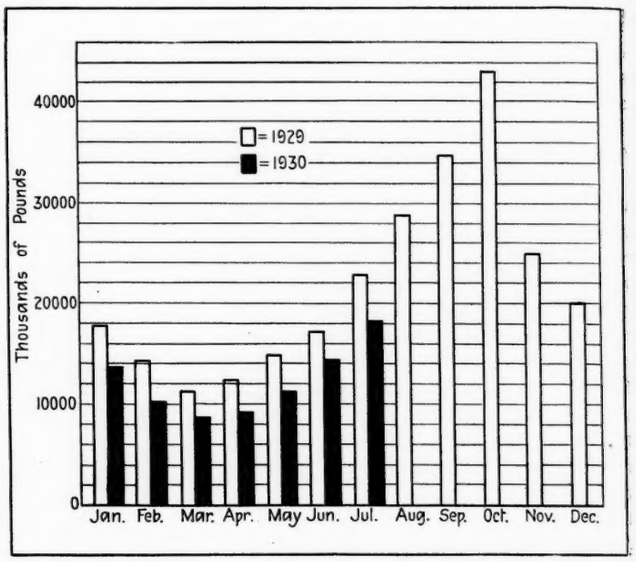
Statistical Service

Based on Data Supplied by the Department of Commerce



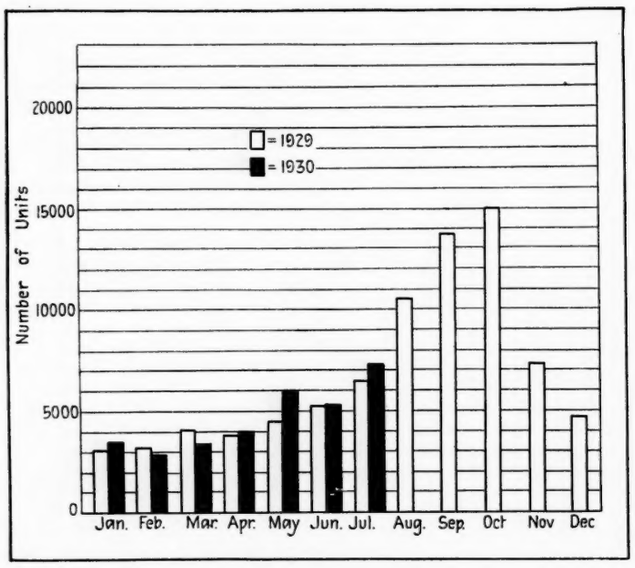
SHIPMENTS OF CAST-IRON RADIATORS
(In 1000 Square Feet)
As Reported by 15 Manufacturers Representing over 90% of the Industry

July, 1930, 7447; July, 1929, 11,729; decrease over last year, 36.4%; total for seven months, 1930, 37,299; for seven months, 1929, 58,137; decrease over last year, 35.8%.



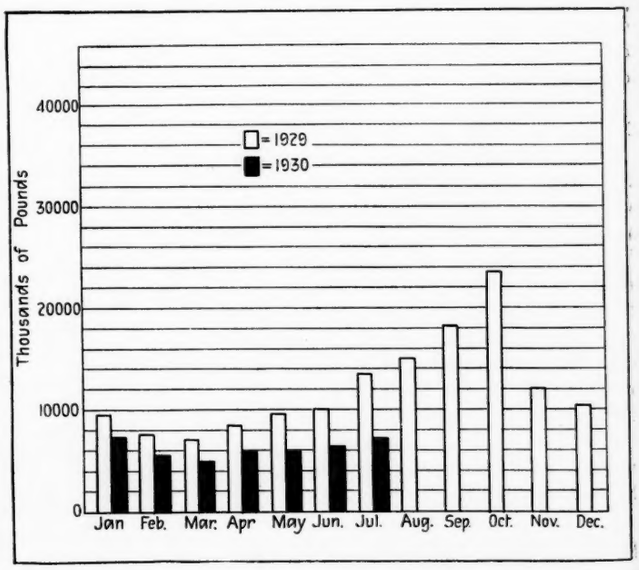
SHIPMENTS OF CAST-IRON SQUARE BOILERS
(In Thousands of Pounds)
As Reported by 25 Manufacturers Representing 90% of the Industry

July, 1930, 18,269; July, 1929, 22,927; decrease over last year, 20.3%; total for seven months, 1930, 86,216; for seven months, 1929, 111,318; decrease over last year, 22.6%.



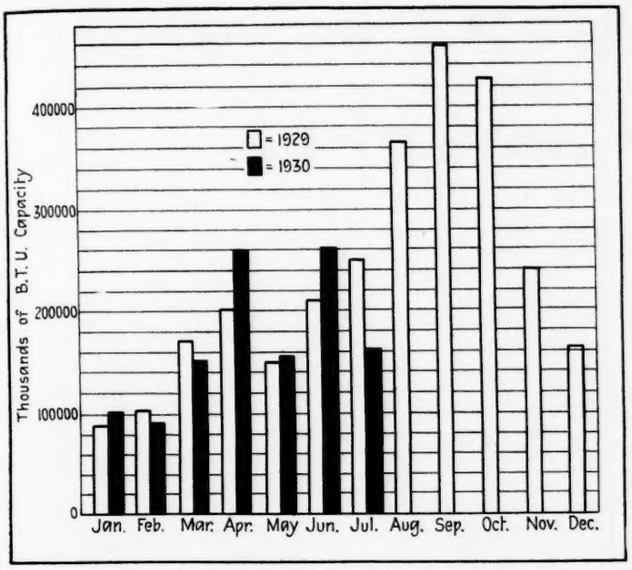
SHIPMENTS OF OIL BURNERS
(In Number of Units)
As Reported by 50 Manufacturers Representing 60% of the Industry

July, 1930, 7241; July, 1929, 6520; increase over last year, 11.1%; total for seven months, 1930, 32,038; for seven months, 1929, 30,330; increase over last year, 5.6%.



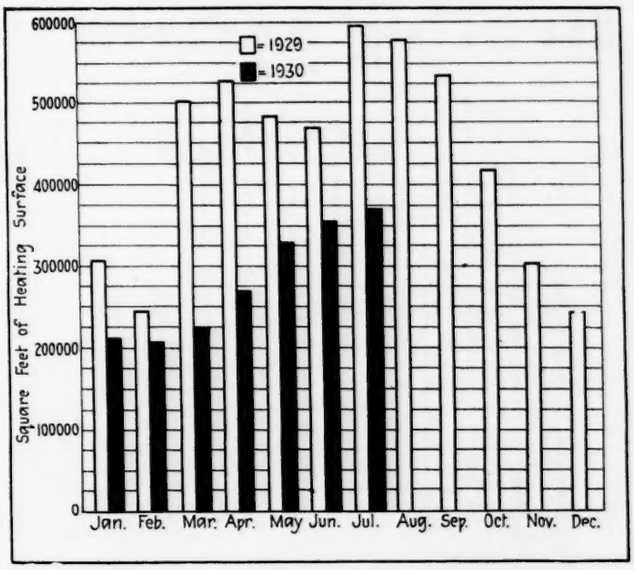
SHIPMENTS OF CAST-IRON ROUND BOILERS
(In Thousands of Pounds)
As Reported by 25 Manufacturers Representing 90% of the Industry

July, 1930, 7266; July, 1929, 13,553; decrease over last year, 46.4%; total for seven months, 1930, 43,114; for seven months, 1929, 66,498; decrease over last year, 20.1%.



SHIPMENTS OF GAS-FIRED BOILERS
(In Thousands of B.T.U. Capacity)
As Reported by 8 Manufacturers Representing 75% of the Industry

July, 1930, 160,347; July, 1929, 254,856; decrease over last year, 37.1%; total for seven months, 1930, 1,178,248; for seven months, 1929, 1,170,948; increase over last year, 0.6%.



NEW ORDERS FOR STEEL HEATING BOILERS
(In Square Feet of Heating Surfaces)
As Reported by Firms Making Up the Greater Part of the Industry

July, 1930, 372,350; July, 1929, 595,431; decrease over last year, 37.5%; total for seven months, 1930, 1,980,262; for seven months, 1929, 3,145,319; decrease over last year, 37.0%.

Heating and Ventilating Construction Above Last Year in New York

According to data compiled by the Heating Board of Trade of New York, heating and ventilating installations in the New York district totaled $49,000,000 for the first eight months of this year, as compared with $40,000,000 for the same period last year.

Duffield Resigns as Executive Secretary of Committee on Research

At a meeting of the A.S.H.V.E. Council, held at the Hotel Statler, Buffalo, N. Y., August 11, the resignation of Thomas J. Duffield as executive secretary of the Committee on Research was accepted. Mr. Duffield has been appointed executive secretary of the Committee on Street and Outdoor Cleanliness of the New York Academy of Medicine.

Members nominated to serve on the Committee on Research for three-year terms are: C. A. Booth, D. S. Boyden, F. B. Howell, Walter Klie and F. B. Rowley.

A discussion of methods of financing and operating the society's research activities took up a considerable portion of the meeting.

Members present were D. S. Boyden, W. H. Carrier, J. D. Cassell Roswell Farnham, C. W. Farrar, F. C. McIntosh, F. B. Rowley, A. V. Hutchinson and L. A. Harding.

New School Building Commissioner in St. Louis

Ernest T. Friton has been appointed Building Commissioner and Architect, by the Board of Education of St. Louis. Mr. Friton was employed in the Building Department of the St. Louis School Board prior to 1916. In 1919 he became identified with LaBaumme and Kline, St. Louis architects, in charge of a comprehensive school building program.

Mr. Friton is a graduate of Washington University and a member of the St. Louis Chapter of the American Institute of Architects.

Humidity in the Home

Issued by the Holland Institute of Thermology, Holland, Mich., "Humidity in the Home" is the first bulletin of their Popular Education Series. The Holland Institute of Thermology was founded in June, 1928 by A. H. Landwehr, president of the Holland Furnace Company, to teach the American homeowner the science of healthful heating through the control of temperature, humidity and air motion.

The bulletin mainly sells the idea of warm-air heating, and the subject of humidity is completely covered in a simple, non-technical manner.

Size 6 in. x 9 in. Pp. 36.

William R. Bush

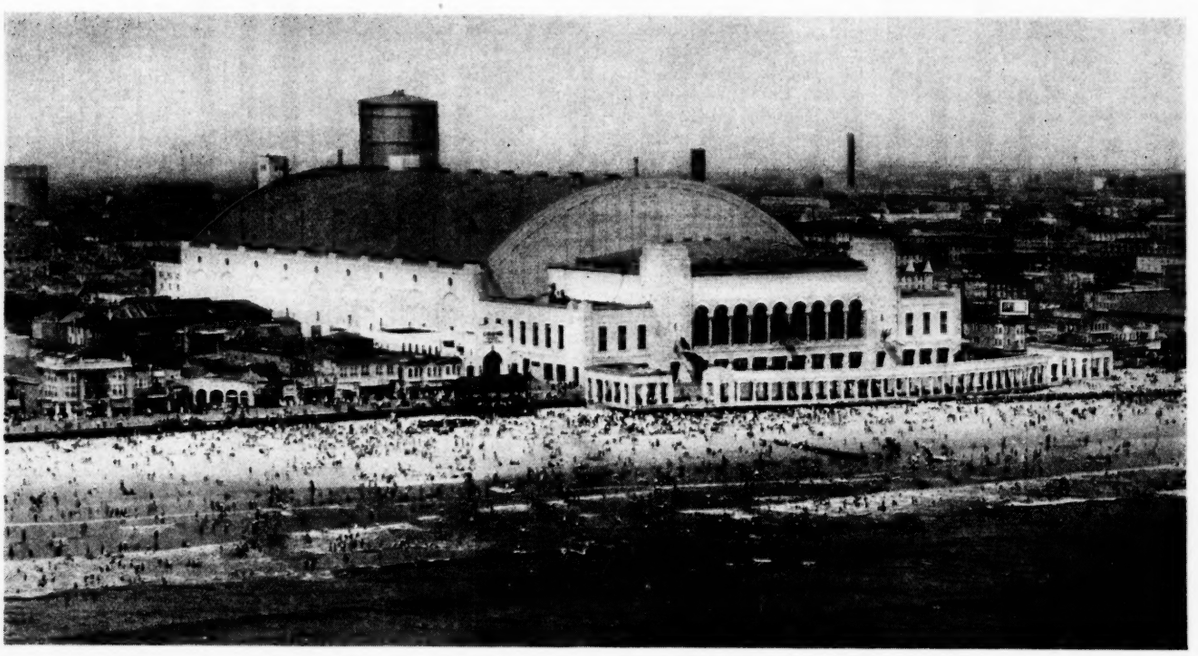
William R. Bush, president of Electrol, Inc., New York, passed away on August 4th after a long illness, and after several operations and blood transfusions.

Mr. Bush was one of the outstanding executives of the oil-burner industry. Eight years ago he started the Home Appliance Corporation as burner distributors in the northeastern territory. This eventually became the Electrol Distributing Corporation, developing later into a leading Electrol outlet. The next step was the absorption of this organization by Electrol, Inc., Mr. Bush becoming president of the latter corporation in April of this year. Mr. Bush was prominent in affairs of the American Oil Burner Association, and was a member of the board of directors, representing the manufacturer division, and of the patent committee. He is survived by a wife and family.

A. O. B. A. Year Book for 1930

The 1930 Year Book of the American Oil Burner Association, the first to be published by this group, was recently mailed to members. It contains a list of the officers, members of the board of directors, standing committees, special committees and directory of members. A history of the association is included, together with a copy of the constitution and by-laws of the American Oil Burner Association, Inc.

Heating Industry Well Represented at A. G. A. Convention



Municipal Auditorium, Atlantic City, where the American Gas Association Convention will be held, October 13-17

ONE out of six of the 240 exhibitors at the twelfth annual convention of the American Gas Association will be from the heating and ventilating industry, reflecting the interest being taken in gas-heating by the heating industry as a whole, and also indicating the importance being placed on the house-heating load by the gas companies.

It is expected that 6500 representatives of the gas industry will attend the convention, which will be held in the Municipal Auditorium at Atlantic City, October 13-17.

The convention will begin with the formal opening of the exhibit to be presented by the manufacturers of gas appliances and equipment which will be staged on the first floor of the auditorium. More exhibitors will occupy greater floor space than at any previous convention. All general sessions will take place in the auditorium ballroom.

Among the papers which will be presented of interest to heating and ventilating engineers will be "Economics of the Conversion Burner," by H. O. Loebell, vice-president of the Combustion Utilities Corp., New York, to be read at the Commercial Section meeting, Tuesday afternoon, October 14. Discussions at the meetings of this session are always lively, particularly when either conversion burners or cooperation with the heating contractor are discussed.

The heating industry will await with interest the report of the Commercial Section containing the tabulation showing the number of gas-fired heating installations by states and by type. Merchandising will be discussed at some length. Among the reports are those of the sub-committee on House-Heating Sales Policy and Plans and of the committee on Relations with Customers.

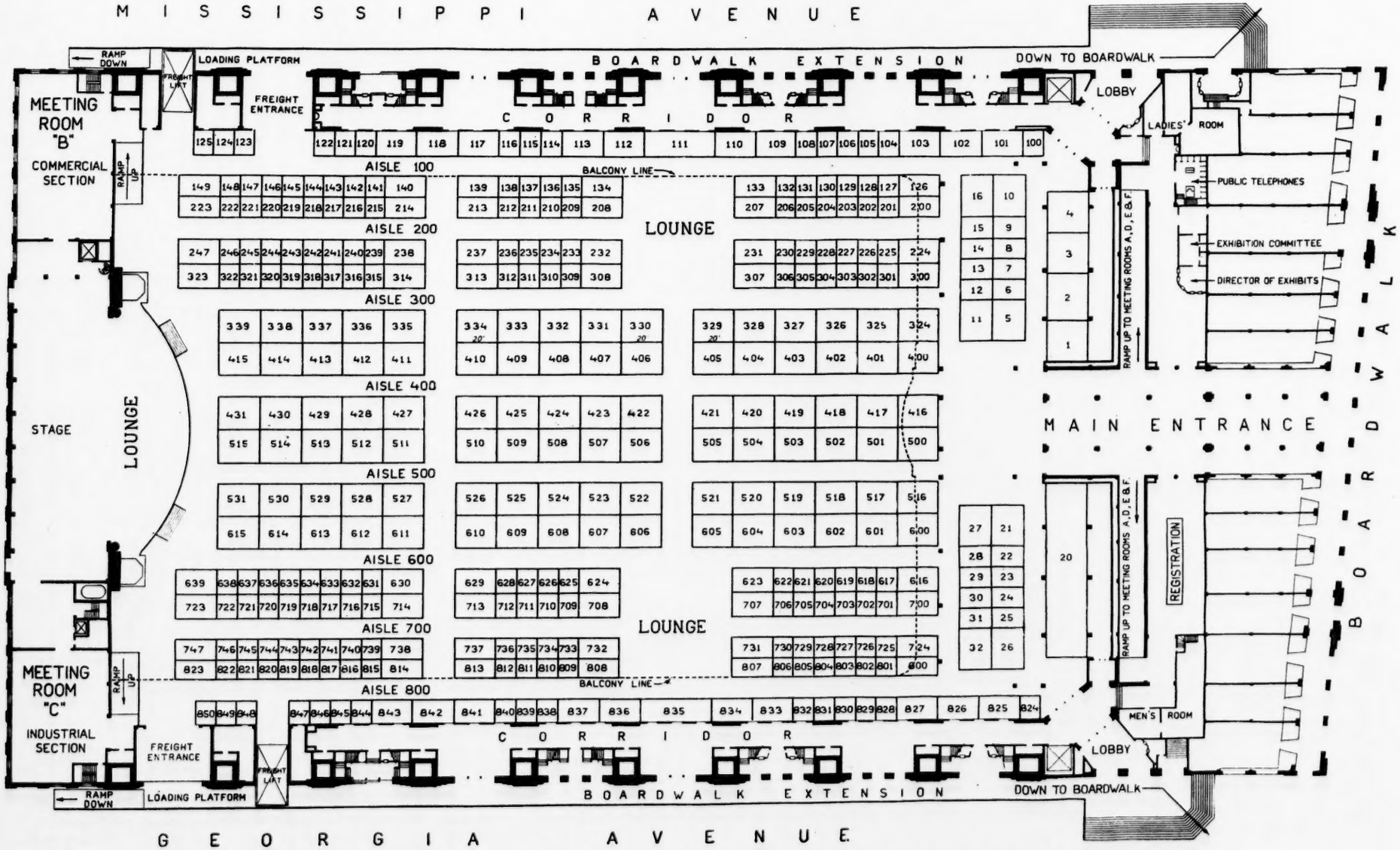
A part of the night session, Wednesday, October 15, will be broadcast from 9 to 9:30 direct from the auditorium ballroom, Halsey Stuart & Company having offered the association their hour on the air.

HEATING AND VENTILATING will have an exhibit at Booth 141 at the convention, and extends a cordial invitation to those attending to make the booth their headquarters while in Atlantic City.

The list of exhibitors with their booth numbers, corrected to the time of going to press, follows:

List of Exhibitors

Abendroth Bros. 425
A-B Stove Co.....608
Adams Bros. Mfg. Co., Inc.....134
Addressograph Co. 724, 800
Air Reduction Sales Co.....834
Alpha-Lux Co., Inc.....617
Aluminate Co., Inc.....312
American Cast Iron Pipe Co.....109
American Foundry & Furnace Co....823
American Gas Furnace Co.144, 45, 218, 19
American Gas Journal.....311
American Gas Products Corp....525, 26
American Heater Corp.....247
American Meter Co...327, 28, 29, 403, 4, 5
American Radiator Co.....525, 26
American Rolling Mill Co.....245
American Stove Co.....506, 7, 8, 9, 10
Amherst-Logan County Coal Corp...107
Andes Range & Furnace Co.....115
Autogas Corp. 149
Automatic Gas Steam Radiator Co...140
Bailey Meter Co.....227
Baltimore Copper Mills.....146
Barber Gas Burner Co.....237
Barber-Greene Co. 5
Bartlett Hayward Co.....517
Bartlett & Snow Co., C. O.....126
Bauer & Black.....108
Beckwith Co. 424
Bernitz Furnace Appliance Co.....229
Bingham & Taylor Corp.....200



Plan of Municipal Auditorium, Atlantic City, as Arranged for Exhibit of American Gas Association

B-Line Boiler Co....338
Blodgett Co., G. S....607
Bowser Service Corp....223
Bristol Co. 807
Bryan Steam Corp....514
Bryant Heater & Mfg. Co....413, 14
Bullard-Davis, Inc. 11
Burroughs Adding Machine Co., ...23, 24, 25, 29, 30, 31
Buxton & Skinner Printing & Stationary Co. 830
Canadian Gas Association....810
Carrier-Lyle Corp. 629, 713
Central Foundry Co....7, 8
Chambers Mfg. Co....624, 25
Chaplin-Fulton Mfg. Co....203, 4
Chicago Bridge & Iron Works....202
Claus Mfg. Co....527
Cleveland Gas Meter Co....704
Cleveland Heater Co....411
Cleveland Trencher Co....324, 25
Clow & Sons, James B....314
Columbia Burner Co....142, 43
Columbus Heating & Ventilating Co. 214, 15
Connelly Iron Sponge & Governor Co. 201
Connersville Blower Co....605
Consumers Construction Co.... 10
Continental Stove Corp....243, 44
Coxhead Corp., R. C....824
Crane Co....728, 29, 804, 5, 832, 833
Cribben & Sexton Co....632, 33, 34, 35
Crown Stove Works....119
Cruse-Kemper Co. 705
Cutler-Hammer, Inc. 801, 2, 3
Dearborn Chemical Co....520
Detroit-Michigan Stove Co.
Garland Div. 611, 12, 13
Jewel Div. 609, 10
Dick Co., A. B....826, 27
Dresser Mfg. Co., S. R....701, 2, 3
Dun-Rite Clock Device Co. 310
Duo-Tor Mfg. Co....211
Econoheat Co. 745
Economy Governor Co....622
Electric Indicator Corp....400
Electrolux Refrigerator Sales, Inc. 530, 31, 614, 15
Elliott Addressing Machine Co...828, 29
Ensign-Reynolds, Inc 606
Eriez Stove & Mfg. Co....710, 711
Estate Stove Co....427, 28, 511
Everhot Heater Co....814
Favorite Stove & Range....843
Felt & Tarrant....825
Fisher Governor Co, Inc....620
Floyd-Wells Co. 808
Fox Furnace Co....815
Foxboro Co., Inc....205, 6
Frigidaire Corp. 837, 38, 39
Fuller & Warren Co....220, 21, 22
Gas & Electric Heater Co....723
Gas Machinery Co....402
Gas Purifying Materials Co....621
General Ceramics Co....118
General Coal Co....133
General Gas Light Co.732, 33, 34, 35, 36, 37
Gestetner-Duplicator Corp. 26, 32
Giant Mfg. Co....132
Glenwood Range Co....512, 13
Groble Gas Regulator Co....731
Guardian Gas Appliance Co...234, 35, 36
Harper-Wyman Mfg. Co....627
HEATING & VENTILATING 141
Hill, Hubbell & Co....300
Hoffman Heater Co....321, 22, 23
Homestead Heater Co....111
Hones, Inc., Charles A....114
Hotstream Heater Co....232
Humphrey Co. 333
Hurley Machine Co....242
Improved Equipment-Russell Engineering Corp. 15
Independent Stove Co....125
Inertol Co. 12
Intercolonial Gas Journal....810
International Business Machines.616, 700
Isbell-Porter Co. 706
J. & G. Brass Co....720
Johns-Manville, Inc. 630, 31
Johnson Gas Appliance Co....722
Judelson Dryer Corp....238, 39
Kelly, Inc., John G....316
Kernit Incinerator Co....308, 9
Kompak Co. 836
Koppers Co. 518
Lambert Meter Co....228
Lamneck Co., W. E....628
Lattimer Stevens Co....207
Lavino & Co., E. J....601
Linde Air Products Co....730
Lindemann & Hoverson Co., A. J.715, 16
Littleford Bros. 102
Lovekin Water Heater Co....639
Maehler Co., Paul....717, 18
Majestic Mfg. Co....117
McEverlast, Inc. 100, 101
McWane Cast Iron Pipe Co....603
Mears-Kane-Ofeldt, Inc. 415
Merco Nordstrom Valve Co....835
Mettler Co., Lee B....821, 22
Meyer Furnace Co....240
Milwaukee Gas Specialty Co....527
Minneapolis-Honeywell Regulator Co. 429, 30
Minwool Insulating Co....135
Mohawk Ashpalt Heater Co....623
Moore Bros. Co....313
Mueller Co. 401
Mueller Furnace Co., L. J.....738, 39, 40
Mulcare Engineering Co....707
National Equipment Corp.... 1
National Lead Co....727
National Tube Co....303, 4, 5, 6, 7
Natural Gas Magazine.... 6
Naylor Pipe Co.... 9
1900 Corp. 116
Ohio Foundry & Mfg. Co....210
Partlow Corp. 339
Patrol Valve Co....412
Peerless Heater Co....139
Peerless Mfg. Co....741, 42
Peninsular Stove Co....714
Pennsylvania Furnace & Iron Co.216, 17
Perco-Steril Machine Corp....246
Permutit Co. 419
Philfuels Co. 416, 17
Pittsburgh Coal Co....103, 4
Pittsburgh-Des Moines Steel Co.....726
Pittsburgh Equitable Meter Co. 225, 26, 301, 2
Pittsburgh Incinerator Co....811
Pittsburgh Water Heater Co..522, 23, 24
Porcelain Enamel & Mfg. Co....233
Public Service Electric & Gas Co.... 20
Public Utilities Reports....131
Ray-Glo Corp. 136
Remington Rand, Inc....21, 22, 27, 28
Republic Steel Corp....120, 21, 22
Reynolds Gas Regulator Co....504, 5
Reynolds & Reynolds....809
Richmond Radiator Co....712
Robbins Publishing Co....500
Roberts & Mander Stove Co....422, 23
Roberts Brass Mfg. Co....334
Roberts-Gordon Appliance Corp...208, 9
Robertshaw Thermostat Co....708, 9
Roots Co., P. H. & F. M....604
Roper Corp., Geo. D....431, 515
Rudy Furnace Co....637, 38
Ruud Mfg. Co....406, 7, 8
Ryan, Scully & Co....721
Safety Gas Lighter Co....813
Safety Gas Main Stopper Co....110
Sands Mfg. Co....426
Savory, Inc. 137, 38
Selas Co. 747
Semet-Solvay Engineering Corp.....326
Sherwin-Williams Co. 127
Skinner Co., M. B....128
Slattery & Bro., J. B....746
Smith Mfg. Co., A. P....230
Spencer Thermostat Co....212, 13
Sprague Meter Co....420
Stacey Bros. Gas Construction Co...605
Stacey Engineering Co....604, 5
Stacey Mfg. Co....602
Standard Gas Equipment Corp.335, 36, 37
Stat-Amatic Instrument & Appliance Co. 636
Sturtevant Co., B. F.... 13
Superior Meter Co....231
Superior Screw & Bolt Mfg. Co.....719
Surface Combustion Co....317, 18, 19, 20
Sweet & Doyle Foundry & Machine Co. 841, 42
Tappan Stove Co....330, 31, 32
Thatcher Co. 840
Time-O-Stat Controls Co....528, 29
Underwood-Elliott Fisher Co....516, 600
United Engineers & Constructors, Inc. 502, 3
U. S. Bureau of Mines.... 2
United States Pipe & Foundry Co...501
Universal Sand Equipment Co.....418
Victaulic Company of America...618, 19
Vulcan Mfg. Co....816
Wailes Dove-Hermiston Corp.....521
Walker & Pratt Mfg. Co....410
Warm Air Furnace Fan Co....743
Watts Regulator Co....315
Weiskittel & Sons....123
Welded Prod 744
Welsbach Co. 112
Western Gas Construction Co.....519
West Gas Improvement Co.... 14
Wilbraham-Green Blower Co....604
Wilcolator Co. 409
Wood & Co., R. D....421
Youngstown Pressed Steel Co.....626
Youngstown Sheet & Tube Co....129, 30

Plans Made for Fifth Midwest Power Conference

At the four-day meeting of the Fifth Midwest Power Engineering Conference, to be held in Chicago, February 10-13, 1931, leading authorities in the heating, refrigerating, mining, electrical and mechanical fields will be asked for expressions of the progress of power application in these fields, thereby giving a comprehensive survey of generation, distribution and utilization in a large way.

The real purpose of the Power Conference at Chicago is to coordinate the various problems in the power field so as to give a broader understanding of applications in many different fields of use. The part of power in our daily life and in special work will find expression in the diversified papers contemplated. Original papers are being arranged with ample opportunity for discussion by leading authorities. The power engineer will find this conference the most outstanding of its kind ever held in this country.

The work of carrying on the four-day meeting will be in the hands of the following officers, recently elected: President, H. W. Fuller; vice-presidents, C. C. Whittier, W. M. White, Charles S. Gladden, Paul Doty, John Hunter, Prof. A. C. Willard; secretary, G. E. Pfisterer; treasurer K. A. Auty.

Additional Boilers, Furnaces and Radiators Approved by American Gas Association

The following house-heating appliances have passed the requirements of the American Gas Association's testing laboratory and are published in addition to the list which appeared in the March and August issues of HEATING AND VENTILATING. The list includes those appliances approved from May 1 to July 31. It does not include radiant heaters.

Boilers

American Radiator Co.,
40 West 40th St., New York.
Trade Name—Ideal

	Output Sq. Ft. Steam Radiation	Rating Sq. Ft. Water Radiation
0-GS-4-C, 0-GW-4-C	270	430
0-GS-5-C, 0-GW-5-C	340	540
0-GS-6-C, 0-GW-6-C	410	660
0-GS-7-C, 0-GW-7-C	480	770
1-GS-4-C, 1-GW-4-C	550	880
1-GS-5-C, 1-GW-5-C	710	1,130
1-GS-6-C, 1-GW-6-C	870	1,390
1-GS-7-C, 1-GW-7-C	1,030	1,640
1-GS-8-C, 1-GW-8-C	1,180	1,890
1-GS-9-C, 1-GW-9-C	1,340	2,150
1-GS-10-C, 1-GW-10-C	1,500	2,400
1-GS-11-C, 1-GW-11-C	1,660	2,650
4-G-41	16,000	25,600

Bryant Heater & Mfg. Co.,
Cleveland, O.
Trade Name—Bryant

Number Model 6		
20 S,W,-GA	7,400	11,840
24 S,W,-GA	8,880	14,210
28 S,W,-GA	10,360	16,580
30 S,W,-GA	11,100	17,760
Remove— Model 44, 6S, W, C, A, CA	1,110	1,780
Change—Model 6 to 63 Change—24-S, W, CA	8,880	14,210

Hook Heater Co.,
Sharpsburg Sta., Pittsburgh, Pa.
Trade Name—Hook

1918	2,760	4,420
2019	2,910	4,670
2120	3,070	4,910

International Boiler Works Co.,
Stroudsburg, Pa.
Trade Name—International

3 (Mfg. Gas only)	1,500	2,400
3 (Mfg. Gas only)	1,270	2,040

***Peerless Heater Co.,**
Boyertown, Pa.
Trade Name—Peerless

5 S3, W3, ST3, WT3	630	1,010
6 S3, W3, ST3, WT3	760	1,220

Simplex Valve & Meter Co.,
Philadelphia, Pa.
Trade Name—Simplex

	918	1,470

The Thatcher Co.,
39 St. Francis St., Newark, N. J.
Trade Name—Thatcher

5 S3, W3, ST3, WT3	630	1,010
6 " " " "	760	1,220
7 " " " "	820	1,310
8 " " " "	930	1,490
9 " " " "	1,050	1,680
10 " " " "	1,050	1,680
11 " " " "	1,280	2,050
12 " " " "	1,400	2,240
13 " " " "	1,520	2,430
14 " " " "	1,630	2,610
15 " " " "	1,750	2,800
16 " " " "	1,860	2,980
17 " " " "	1,980	3,170
18 " " " "	2,100	3,360
19 " " " "	2,210	3,540
20 " " " "	2,330	3,730
5 S5, W5, ST5, WT5	1,730	2,770
6 " " " "	2,080	3,330
7 " " " "	2,410	3,880
8 " " " "	2,770	4,440
9 " " " "	3,110	5,000
10 " " " "	3,470	5,660
11 " " " "	3,820	6,110
12 " " " "	4,170	6,660
13 " " " "	4,510	7,220
14 " " " "	4,860	7,780
15 " " " "	5,200	8,330
16 " " " "	5,550	8,890
17 " " " "	5,890	9,430
18 " " " "	6,240	10,000
19 " " " "	6,590	10,550
20 " " " "	6,940	11,100
21 " " " "	7,280	11,640
22 " " " "	7,630	12,210

John Wood Mfg. Co.,
Conshohocken, Pa.
Trade Name—Wood

1	690
2	830
3	970
4	1,110
5 (Nat. Gas only)	1,310
6 (Nat. Gas only)	1,400

Furnaces

Aladdin Heating Corp.,
5107 Broadway, Oakland, Calif.
Trade Name—Aladdin

	Input Rating B.T.U. per hr.
5	70,000
10	140,000

American Foundry & Furnace Co.,
Bloomington, Ill.
Trade Name—American

14	86,000

***Atlas Heating & Ventilating Co.,**
557 Fourth St., San Francisco, Calif.
Trade Name—Atlas

2-A	65,000
3-A	85,000

Davton Power & Light Co.,
Dayton, O.
Trade Name—Daytona

615	85,000
815	128,000
915	171,200

Fox Furnace Co.,
Elyria, O.
Trade Name—Sunbeam

Model A	
1	70,000
2	140,000
3	210,000
4	280,000
5	350,000
6	420,000

***Fraser Furnace Co.,**
445 S. San Joaquin St., Stockton, Calif.
Trade Name—Fraser

30	55,000
40	82,500
50	110,000
60	137,000
70	165,000
80	220,000
90	275,000
100	330,000

Hart Mfg. Co.,
2006 N. Western Parkway, Louisville, Ky.
Trade Name—Hart (With Blower)

1	90,000

Lennox Furnace Co.,
Marshalltown, Ia.
Trade Name—Torridzone

350	60,000

McLaughlin Sheet Metal Works,
1912 Eye St., Sacramento, Calif.
Trade Name—Tayho

103	49,500
105	82,500
107	105,000
108	135,300

L. J. Mueller Furnace Co.,
167 Reed St., Milwaukee, Wis.
Trade Name—Gas Era

	Input Rating B.T.U. per hr.
7, 70	455,000
8, 80	520,000
9, 90	585,000
10, 100	650,000
1S	45,000
2S	90,000
3S	135,000
4S	180,000
5S	225,000
6S	270,000
7S	315,000
8S	360,000
9S	405,000
10S	450,000

Rudy Furnace Co.,
Dowagiac, Mich.
Trade Name—Bon Air

240	240,000

Emil Steinhorst & Sons, Inc.,
Utica, N. Y.
Trade Name—Steinhorst

2	135,000

Circulators

Advance Stove Works,
Evansville, Ind.
Trade Name—Flasheat

	Input Rating B.T.U. per hr.
8830	36,000

Area Sales & Mfg. Co.,
112 So. Michigan Blvd., Chicago, Ill.
Trade Name—Sunheat

51	20,000

Columbus Iron Works,
Columbus, Ga.
Trade Name—Gas Glo

	40,000

Continental Stove Corp.,
Ironton, O.
Trade Name—Lawson

1610 (natural gas)	16,500
1610 (manufactured gas)	17,500

Cribbin & Sexton Co.,
Chicago, Ill.
Trade Name—Universal

157	15,000
187	18,000
217	25,000

Detroit Michigan Stove Co.,
Detroit, Mich.
Trade Name—Detroit Jewel

6056	50,000

Trade Name—Southwestern

10	80,000

J. D. Gerken Co.,
Toledo, O.
Trade Name—Gastinette

300	50,000

Guardian Gas Appliance Co.,
1364 East 46th St., Cleveland, O.
Trade Name—Guardian

1	28,000

Montgomery Ward Co.,
Chicago, Ill.
Trade Name—Argyle

GC 30-7	30,000

Moore Bros. Co.,
Benton St., Joliet, Ill.
Trade Name—Puritan

18A2714, 18A2715, 18A2740	70,000

New Method Stove Co.,
Elm St., Mansfield, O.
Trade Name—New Method

90	24,000

Odin Stove Mfg. Co.,
302 West 12th St., Erie, Pa.
Trade Name—Odin

718	18,000
721	25,000

Quality Stove & Range Co.,
Belleville, Ill.
Trade Name—Quality

393 NN	30,000
394 NN	40,000

F. O. Schoedinger, Columbus, O.	Imput Rating B.T.U. per hr.
Trade Name—Thermoray	
0T2	12,000
VT3, CT3, 1T3, TT3, 0T3	18,000
VT4, CT4, 1T4, TT4, 0T4	24,000
VT5, CT5, 1T5, TT5, 0T5	30,000
Trade Name—Thermola	
CT	24,000

Steam Radiators

American Gas Products Corp., Chrysler Bldg., New York	Imput Rating B.T.U. per hr.
Trade Name—A.G.P. Corto	
6 col. 10 sec. 38" Vented	24,000
5 col. 10 sec. 26" Unvented	21,840
Automatic Gas Steam Radiator Co., Pittsburgh, Pa.	
Trade Name—Elite	
7 col. 5 sec. 32" unvented	19,000
7 col. 7 sec. 32" unvented	26,000
7 col. 9 sec. 32" unvented	35,000
Trade Name—Pittsburgh	
5 col. 8 sec. 38" vented	18,000
5 col. 10 sec. 38" vented	21,000
5 col. 15 sec. 38" vented	35,000
Pittsburgh Water Heater Co., Carnegie, Pa.	
Trade Name—Monarch	
5 col. 4 sec. 38" Unvented	10,200
5 " 6 " " "	15,300
5 " 8 " " "	20,400
5 " 10 " " "	25,500
5 " 12 " " "	31,200
5 " 15 " " "	38,200
5 " 4 " 27" "	6,380
5 " 6 " " "	9,600
5 " 8 " " "	12,780
5 " 10 " " "	15,960
5 " 12 " " "	19,200
5 " 15 " " "	23,900
5 " 4 " 22" "	5,780
5 " 6 " " "	8,650
5 " 8 " " "	11,500
5 " 10 " " "	14,350
5 " 12 " " "	17,300
5 " 15 " " "	21,500
7 " 6 " 32" "	22,400
7 " 8 " " "	30.000
7 " 10 " " "	40,000

**Indicates Changes in Existing List.*

Approval Requirements for Gas-Fired Equipment

Requirements for the approval of central heating gas appliances have been revised by the American Gas Association and published in a booklet issued September 1. However, the new requirements are not effective until September 1, 1931. They represent minimum standards for safe operation, satisfactory performance and durable construction, and apply to gas boilers, warm-air furnaces, and gas-fired unit heaters.

Size 6¾ in. x 9¾ in. Pp. 42. Published by the Sub-Committee on A.G.A. Approval Requirements for Central Heating Gas Appliances, American Gas Association, 420 Lexington Ave., New York.

Architects of the Carew Tower Building, Cincinnati

In the advertisement of the Marsh Valve Company in HEATING AND VENTILATING for September, 1930, reference was made to the Carew Tower Building, Cincinnati, which is equipped with Marsh Cone Disc Packless Valves. The architect of this building is Walter W. Ahlschlager, and the associate architects, Delano & Aldrich. Their names were incorrectly given in the advertisement.

Williams Oil-O-Matic Wins Infringement Suit

In a patent infringement suit brought by Doble Laboratories against the Thomas Day Co., of San Francisco, a dealer of the Williams Oil-O-Matic Heating Corporation, a decision has been rendered by the U. S. Court of Appeals in favor of Williams Oil-O-Matic Heating Corporation.

The suit was brought by Doble Laboratories in December, 1924, for infringement of Doble patents No. 1,131,683 of March 16, 1915 and No. 1,359,042 of November 16, 1920. A hearing was had during the month of November, 1928, and the court held that the Doble patents were valid and infringed by the Oil-O-Matic oil burner. Williams Oil-O-Matic Heating Corporation took an appeal which was heard during June, 1930, and July 7, 1930, the Court of Appeals reversed the decision of the lower court and held that the Doble patents, while valid, were not infringed by the Oil-O-Matic oil burner. Doble petition for rehearing was denied August 26, 1930.

Ventilating Products Win Patent Infringement Suit

In a suit for patent infringement brought by the Knowles Mushroom Ventilator Company against the 138 West 42nd Street Corporation, owner of the Cameo Theatre, N. Y., in connection with the installation of Turtleback air diffusers, a final decision in favor of the defendants has been rendered by the U. S. Court of Appeals, New York district.

In this suit, the Ventilating Products Company, for its own protection as well as that of its customers, filed a petition March 28, 1928, requesting that it be made a party in defending the suit, and this request was granted.

On June 12, 1928, the plaintiff applied for an injunction to restrain the Ventilating Products Company from the manufacture and sale of Turtleback diffusers. This application was denied by Judge D. J. Knox. On October 23, 1929, the case proceeded to trial and a decision was granted in favor of the defendants by Judge Francis G. Caffey of the U. S. District Court for the Southern District of New York. On July 29, 1930, a final decision in favor of the defendants was rendered by the U. S. Court of Appeals, New York District by Judges Manton, Augustus N. Hand and Chase.

It was brought out in the trial that the Mushroom ventilator patent was issued principally on the claim that the device is supported at points near its periphery. In its final decision the Appellate Court stated: "But, having of necessity elected to take a patent in express terms limited to steps integral with the ring and extending laterally from positions adjacent to the periphery thereof it is now too late to claim more.

"The defendants' device, having steps placed in an entirely different position that does away with some of the air obstruction inherent in the plaintiffs' patent structure, can be thought to infringe only by giving to the plaintiffs' patent the advantage of a broad scope three times claimed and three times properly denied while the application was pending. Such a construction of its claims would require us to hold the patent anticipated and without it no infringement has been shown."

Oil Trades Equipment Association Formed in New York

Announcement is made of the formation of the American Oil Trades Equipment Association, Inc., membership of which comprises representative firms and individuals—manufacturers, jobbers, and distributors—whose business consists principally or in substantial part of supplying equipment to the oil trades, including the oil burner industry, the gasoline industry and allied trades.

The purpose of the association is to foster and promote among its members and the oil trades equipment industry generally a high standard of trade ethics and good will, thereby increasing the scope of service of its members to the industries they serve. In addition, the association will provide for its members complete facilities for the interchange of credit information.

Officers of the association are Thomas F. X. O'Connell, National Tank Co., president, J. P. Van Overmeer, Petrometer Corp., vice-president, and P. G. Fitzpatrick, secretary-treasurer. The Board of Directors consists of the above named officers, including J. F. Renick, Renick & Mahoney, Inc., and C. H. Meister, Preferred Utilities Mfg. Corp. Mr. A. G. Kraus is general counsel to the association.

Among the organizations represented at the first annual meeting of the association were Cole-Duncan Boiler Works, Inc., Long Island City, N. Y., Liquidometer Corp., Long Island City, N. Y., Preferred Utilities Mfg. Corp., New York, National Tank Co., New York, Petrometer Corp., Long Island City, N. Y., Renick & Mahoney, Inc., New York, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., Pneumercator Co., Inc., New York, and Treesdale Mfg. Co., Grand Rapids, Mich.

Domestic Oil Burners Listed by Underwriters' Laboratories from May 23 to August 22, 1930

Aladdin Oil Burner Corp., 375 Washington St., Newark, N. J. Mechanical draft; a.c. motor drive; combustion control, Minneapolis-Honeywell BPR-1 Protectorelay, type A combustion thermostat or Mercoid SM Pyratherm; automatic temperature control; gas ignition; oil fuel not heavier than No. 3; fuel feed, suction from supply tank; marking, label on burner base, type SM on Mercoid combustion thermostat or type A on Minneapolis-Honeywell combustion thermostat.

Bettendorf Mfg. Co., 2527 State St., Bettendorf, Ia., Mechanical draft; a.c. motor drive; combustion control, Minneapolis-Honeywell R-103-1 Protectorelay, type A or B combustion thermostat, type H, models A and B burners, or Time-O-Stat No. 77 Lockswitch with 48-H combustion thermostat type H burner only; automatic temperature control; electric or gas-electric ignition; oil fuel not heavier than No. 3; fuel feed, suction or gravity from supply tank or listed automatic pump; marking, label on blower housing, type A or B on Minneapolis-Honeywell or 48-H on Time-O-Stat combustion thermostat.

Crystal Oil Burner Corp., 1440 Broadway, New York. Mechanical draft; a.c. or d.c. motor drive; anti-flooding control, Mercoid type A safety drip switch; automatic temperature control; gas ignition; oil fuel not heavier than No. 1; fuel feed, suction from supply tank or gravity from supply tank or listed automatic pump; marking, label on blower housing and L-1 or L-2 on cracking chamber and on firepot.

Fluid Heat Inc., 2111 N. Charles St., Baltimore, Md. Mechanical draft; a.c. motor drive; combustion control, Minneapolis-Honeywell BPR-1 Protectorelay, type A or B combustion thermostat or Time-O-Stat No. 77 Lockswtch with 48-H combustion thermostat; automatic temperature control; gas ignition; oil fuel not heavier than No. 2; fuel feed, gravity from supply tank or listed automatic pump; marking, label on control stand, also type R, model A on burner motor and on combustion thermostat, also type R, model A on constant level device, or listed marking on automatic pump.

Ideal Liquid Heat Machine Corp., 2835 Washington Blvd., St. Louis, Mo. Mechanical draft; a.c. motor drive; combustion control, Minneapolis-Honeywell type A or BPR or R-103-1 Protectorelay with type A combustion thermostat; automatic temperature control; electric ignition; oil fuel not heavier than No. 3; fuel feed, suction from supply tank; marking, label on blower housing.

Malleable Iron Fittings Co., Branford, Conn. Mechanical draft; a.c. motor drive; combustion control, Minneapolis-Honeywell R-101 Protectorelay, B-6 combustion thermostat or Minneapolis-Honeywell U-10-C Protectorelay with A-4 or B-3 combustion thermostat, Time-O-Stat No. 77 Lockswitch with 48-H combustion thermostat, Penn Heat Control D-1 relay with B-1 or A-1 combustion thermostat, F-1 or F-2 relay with A-1 combustion thermostat; automatic temperature control; electric ignition; oil fuel not heavier than No. 3; fuel feed, suction from supply tank; marking, label on blower housing, B-6 or B-3 or A-4 on Minneapolis-Honeywell combustion thermostat, 48-H on Time-O-Stat combustion thermostat, B-1 or A-1 on Penn Heat Control combustion thermostat.

May Oil Burner Corp., 3500 E. Biddle St., Baltimore, Md. Mechanical draft; a.c. or d.c. motor drive; combustion control, Minneapolis-Honeywell DSS program motor switch with type B combustion thermostat, Minneapolis-Honeywell type A Protectorelay with type B or A combustion thermostat, Minneapolis-Honeywell TIR Protectorelay with type A or B combustion thermostat, Time-O-Stat No. 77 Lockswitch with 48-C or 48-H combustion thermostat, SDP or SDE Adjustatherm with M-1 or L combustion thermostat or Penn F-1 or F-2 relay with A-1 combustion thermostat; automatic temperature control; electric ignition; oil fuel not heavier than No. 3; fuel feed, suction from supply tank; marking, label on blower housing, type A or B on Minneapolis-Honeywell combustion thermostat, 48-C or 48-H on Time-O-Stat combustion thermostat, M-1 or L on Mercoid combustion thermostat, A-1 on Penn combustion thermostat, OB on Titeflex flexible hose coupling when used.

Messer Co., The, Inc., 629 Central Ave., Newark, N. J. Mechanical draft; a.c. motor drive; combustion control, Time-O-Stat No. 77 Lockswitch with 48-H combustion thermostat, or Minneapolis-Honeywell BPR-1, R-100-1 or R-101-1 Protectorelay with type A or B combustion thermostat; automatic temperature control; electric ignition; oil fuel not heavier than No. 4; fuel feed, suction from supply tank; marking, label on blower housing, No. 77 on Time-O-Stat Lockswitch with 48-H on combustion thermostat, BPR-1, R-100-L or R-101-1 on Minneapolis-Honeywell Protectorelay with type A or B on combustion thermostat.

Mid-West Oil Burner Mfg. Co., 3227 Carroll Ave., Chicago, Ill. Mechanical draft; a.c. motor drive; combustion control; Minneapolis-Honeywell R-105 Protectorelay with type A combustion thermostat; automatic temperature control; gas ignition; oil fuel not heavier than No. 4; fuel feed, suction from supply tank; marking, label on blower housing, model No. 211 or 311 on strainer, on combustion thermostat and on fire face.

Nu-Way Corp., The, Rock Island, Ill. Mechanical draft; a.c. or d.c. motor drive; combustion control, Minneapolis-Honeywell DSS motor switch and type B combustion thermostat or type G control switch and E-1 combustion thermostat for burners E-20, D-30, D-40 and D-50. Minneapolis-Honeywell type G control switch and E-1 or Mercoid type L combustion thermostat for burner H-10. Minneapolis-Honeywell type G control switch and E-1 combustion thermostat or Time-O-Stat No. 77 Lockswitch and 48-C combustion thermostat for burner O-5. Minneapolis-Honeywell type A Protectorelay with type A combustion thermostat or Mercoid type S Adjustatherm with type L combustion thermostat or Time-O-Stat No. 77 Lockswitch with 48-C combustion thermostat for burners HP-25, HP-35, and HP-55. Minneapolis-Honeywell R-101 Protectorelay with B-10 combustion thermostat or Time-O-Stat No. 77 Lockswitch with 48-H combustion thermostat for burner HP-15; automatic temperature control; gas-electric or electric ignition; oil fuel not heavier than No. 3, types D, E, G-5 and HP, not heavier than No. 2, model H-10; fuel feed, gravity from supply tank or listed automatic pump, types D, E and G-5 and model H-10, or suction from supply tank, type HP; marking, label on burner cover or blower housing, type E-1, B or A on Minneapolis-Honeywell combustion thermostat, No. 77 on Time-O-Stat Lockswitch and 48-C on combustion thermostat, 48-H on Time-O-Stat combustion thermostat, or type L on Mercoid combustion thermostat.

Roberts Engineering Co., 809 E. 17th St., Portland, Ore. Mechanical draft; a.c. motor drive; combustion control, Time-O-Stat No. 77 Lockswitch with 48-H combustion thermostat, or No. 88

Lockswitch with 48-HB combustion thermostat, Minneapolis-Honeywell BPR-1 Protectorelay with type A or B combustion thermostat, Mercoid SDP Adjustatherm with type M-1 combustion thermostat, or Penn Heat D-1 control unit with type A or B combustion thermostat, type B burners, or Time-O-Stat No. 77 Lockswitch with 48-H combustion thermostat, type H burners; automatic temperature control; electric ignition; oil fuel not heavier than No. 3; fuel feed, suction from supply tank; marking, label on blower housing, 48-H on Time-O-Stat combustion thermostat, or type B on combustion thermostat.

Silent Automatic Corp., 12001 E. Jefferson Ave., Detroit, Mich. Mechanical draft; a.c. or d.c. motor drive; combustion control, Minneapolis-Honeywell PRO-1 or R-101-1 Protectorelay with type B combustion thermostat, or Penn Heat D-2 control with A-2 combustion thermostat, or type F-2 control with A-1 combustion thermostat; automatic temperature control; gas or electric ignition; oil fuel not heavier than No. 1, model E burner, not heavier than No. 2, model A burner and model B burner with electric ignition, not heavier than No. 3, model B burner with gas ignition; fuel feed, gravity from supply tank or listed automatic pump; marking, label on control unit case, also model A on burner base or model B on burner motor or model E on burner motor, S-2 on constant level chamber, type B on Minneapolis-Honeywell combustion thermostat, or D-2 or F-2 on Penn Heat combustion thermostat.

Sundstrand Engineering Co., 1124 11th St., Rockford, Ill. Mechanical draft; a.c. motor drive; anti-flooding device, own manufacture trip switch, type 4-B, combustion control, Minneapolis-Honeywell type A Protectorelay with type A combustion thermostat, C-5 burner, or Minneapolis-Honeywell BPR-1 Protectorelay with type A or B combustion thermostat, types A-3, B-5 and C-6 burners; automatic temperature control; electric ignition; oil fuel not heavier than No. 2, types 4-B and C-5, not heavier than No. 3, types A-3, B-5 and C 6; fuel feed, suction from supply tank; marking, label on blower housing, type 4-B on fire door assembly, fire bowl and fire-bowl stand, JR-10 on relay, type 4-B only, type C-5 on fire door assembly and type A on relay.

Timken-Detroit Co., The, 100-400 Clark Ave., Detroit, Mich. Mechanical draft; a.c. motor drive; combustion control, Minneapolis-Honeywell R-101 Protectorelay with type B combustion thermostat; automatic temperature control; gas or electric ignition; oil fuel not heavier than No. 2; fuel feed, gravity from supply tank or listed automatic pump.

B. T. U. Club

Direct Selling Vs. Selling Through Agents

MR. CHAIRMAN:

Selling technical products is quite different from selling automobiles, soap, or lead pencils. Those interested in the sale of technical products can well testify to the sales difficulties in this field—the almost impenetrable sales resistances to be overcome.

A manufacturer of technical products recently stated to me that "we are very much undecided as to the right sales method to adopt," and I judge there are others of the same frame of mind.

Agreeing that technical products are sold to technical men or to those who have the technical viewpoint, the question is, which is the better plan—direct selling or selling through agents?

Direct selling involves the selection of capable men, opening of branch offices and creating a sales overhead that requires constant watching and supervision. Money is invested in a salesman who may prove to be a disappointment, another salesman is appointed and the investment in the first is lost. Added to this is the skepticism on the part of the consumer who gets the impression that the fault is with the company rather than with the salesman.

On the other hand, if the salesman does prove to be successful the salesman becomes increasingly important in his own estimation. He feels that he can run the company better than the existing executives, and his prosperity in general goes to his head.

The advantage of selling through agents is that the salesman is in business for himself and has either built up a good business or he has the ambition to do so. As a business man he functions as such in the community and is respected by those with whom he comes in contact. He finances himself and takes his earnings on a commission basis, so that he is an important factor in preventing price cutting, as any cut in price that he gives must come out of his own commission.

Of the two plans I believe that the method of selling through agents is the better. I agree that choosing the agent is most important in establishing a successful sales policy along these lines.

Generally speaking, advocates of direct selling will admit that the big problem confronting them is to secure intelligent men who can and will absorb the technical details and sales points of the products. I feel that a survey would show that a greater percentage of parasite salesmen exist in this field than in the other. If such is not the case why is it that the salesman turnover is so great in direct selling?

Comparing this method with that of using sales agents, I believe it will be found that the turnover is negligible. My favorable attitude to sales agents is based on past experience, and where I found that I had a weak agent, and I have had them, before I assumed that he was not the right type, I cross examined myself and in all cases found that it was my fault and not the agent's. In many cases I had innocently neglected to get closer to the weak agent, my correspondence was not so warmly written, etc. As soon as I became alive to the situation I placed the weak agent on a preferred list, and that salesman would become the strong agent.

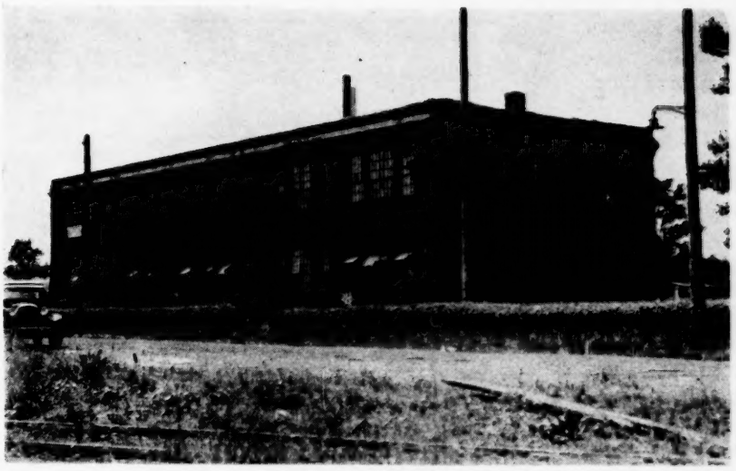
Manufacturers, however, say that they do not want their products handled as a side line. On the other hand, how many products are there honestly entitled to be handled as a side line? There are quite a number. If the manufacturer is willing to admit that his product is only a side line, he should be honest with himself and the agent and do his level best to make it a good side line. If it should be a major account, the manufacturer should remember that the responsibility is his and not the agent's. The agent is but the tool the manufacturer works with and the agent should be cooperated with, should receive cheerful letters and his achievements be appreciated. He should not be treated as an employee, as he is a business man.

The greatest faults with the agent-selling methods are due to weaknesses on the part of the manufacturers. The manufacturers rush around the country appointing agencies and agents by a sales-talk method, and in most cases they are talking to a man not intimately familiar with the product; the agent is appointed and the contracts executed and the deal is carried through. I, myself, appoint agents by mail and have appointed 32 in one case and 28 in another, and each job was completed inside of 30 days.

However, to use the agent-method of selling, the sales plan must be right, must be well thought out and there must be an everlasting continuity of cooperation, thoughtfulness, consideration and appreciation.

CHARLES H. GAGEN.

New York, N. Y.



New Anthracite Institute Laboratory, Primos, Pa.

Anthracite Institute Opens New Laboratory

TESTING and experimental work on equipment designed for the utilization of anthracite fuel is well under way at the Anthracite Institute Laboratory, which began operations July 15 at its new building at Primos, Pa., 8 miles from Philadelphia.

The relatively slow natural development of such phases of completely automatic heat as domestic fuel handling, removal of ash from cellars and an expansion of methods of utilizing the larger sizes suggested the necessity for incorporating the deve'opment of equipment as a major purpose of the laboratory, in addition to that of testing existing equipment.

The laboratory, which is under the direction of Allen J. Johnson, is a 120 ft. x 40 ft. brick and concrete building two stories high, which was originally constructed as an analytical and testing laboratory. For this reason many features of design were included which could not have been found in a commercial building constructed for other purposes.

Basic equipment of the laboratory consists of 10 cast-iron and steel boilers of six prominent makes. These have been carefully selected in order to provide a testing medium for stokers and equipment of all sizes. An important part of the testing and development program will consist of a determination of boiler sizes to which specific equipment is best adapted.

Among the stokers being tested are the Phantom, Electric Furnace-Man, Whitney, Auto Coala, Losch, an overfeed type developed by the Detroit manager of the Anthracite Coal Service, the Erie automatic heat generator and the Fuel Saver. Laboratory tests have been completed on the Losch stoker, which is a combined stoker and boiler unit in which the entire grate is moved backward and snapped forward violent'y by means of a revolving cam at the front of the furnace. This action of the grate causes the coal literally to flow to an ashcan at the rear of the boiler. These tests revealed very little difference in efficiency between the combustion of several sizes of anthracite, ranging from pea to buckwheat.

Wherever possible, boilers of similar sizes have been grouped together with ample space between for ready access. Testing facilities have been so centralized that it is unnecessary to group an array of instruments around a particular boi'er in order to conduct a test.

The almost complete absence of temporary testing arrangements, wiring and piping, is a feature of the laboratory. Permanent connections are made to two centralized instrument panels located at the ends of the boiler aisles. The main boiler foundations include, in addition to convenient outlets for connecting such auxiliaries as stokers and boilers, complete piping for obtaining the CO_2, draft, and temperatures of each boiler. Connections to the latest types of recording instruments on the two instrument boards are readily made by means of terminal manifolds at the ends of the boiler foundations. The only physical change necessary in the laboratory to place a boiler on complete test consists of connecting the particular boiler pipes to the instrument by means of short lengths of rubber hose. Connections to two potentiometer pyrometers for securing temperatures throughout the laboratory are made at a centralized bus board.

Fourteen temperatures made by this means may be recorded at one time by the simple expedient of plugging pins into the board. The flexibility of this system is apparent from the fact that any fourteen of twenty-four permanently installed thermocouples may be connected either to an instrument having a maximum range of 1000° or to a high temperature instrument reading to 2000°.

Every precaution has been taken to assure the accuracy of all laboratory work by providing several methods of measuring each of the vital items in the individual tests. As an example, the feed water system, while simple to operate, includes three separate methods of measurement. Water fed from the city mains is discharged into a tank on a self-reading scale from which it is pumped into calibrated tanks for gravity feed to the boilers through aluminum disc water-meters.

As a further precaution against inaccuracy of water measurements, the engineer in charge of individual tests operates independently of the assistant, who is responsible for water weights. The engineer, therefore, is free to conduct frequent checks upon the accuracy of the materials which his test is receiving. He thus is provided with means of determining instantaneously the percentage of error in any measure-

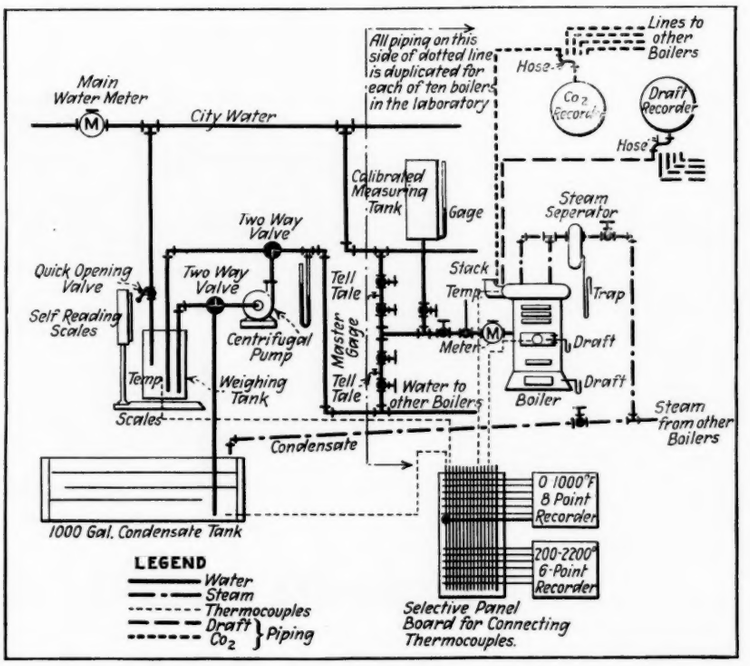
ment of water which may be pumped to his boiler.

As an illustration of the value of these testing facilities and precautions in plotting the results of the first series of twenty tests upon a stoker in the laboratory, only three points failed to follow sufficiently close to a smooth curve of efficiency as to be of no assistance in a determination of the shape of the line.

Coal weights likewise are secured against inaccuracies through an inventory of all coal placed in the laboratory, and through the expedient of so arranging the layout of equipment that all coal removed from the line of bins extending across the entire width of the building must pass over the built-in platform scales in order to reach the testing floor.

The advantages of such a layout are several. The permanent location of the instruments tends to preclude the use of temporary wiring and piping with the resultant possibility of error. The central arrangement is such that any boiler may be placed on a complete test in accordance with approved codes in less than five minutes. Lost time due to the connection of instruments, and arrangement of equipment for testing is brought to a minimum. However, the greatest advantage of the centralization of readings lies in the fact that comparative tests may be run side by side and may be observed from one control point.

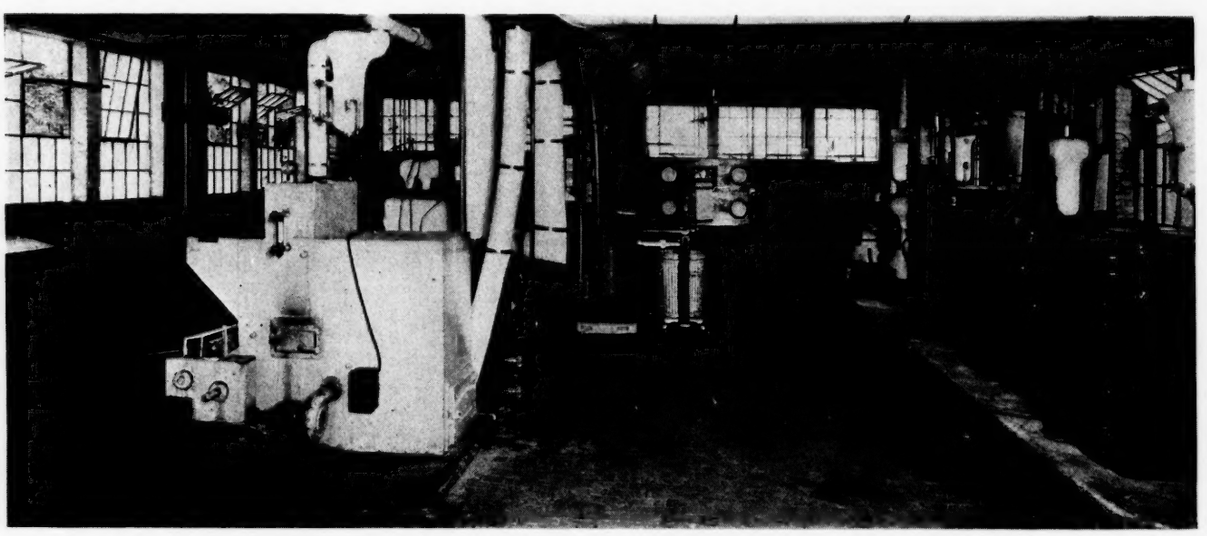
Stoker testing, however, is but one phase of the laboratory program. Equipment has been provided in which various types of thermostatic controls, ranging from the simplest to the more elaborate timed devices, may be tested in a room surrounded by conditioned air at any desired temperature. By means of recording instruments, a complete record can be secured of the number of operations of the thermostat, of its effectiveness in maintaining constant room temperatures, of its lag, and of other physical details. Methods of cooling the air surrounding the inner chamber include the circulation of chilled air by means of a variable speed fan which will simulate any desired temperature.



Piping Diagram for Anthracite Institute Laboratory

Blowers and fans for forced draft are tested in a standard tunnel designed for measuring the output under all given conditions of static pressure and motor speed. The arrangement also includes the necessary instruments for studying the operation of the unit together with the power consumption of the driving motor.

In addition to the specific study of equipment, arrangements have been made for conducting a number of combustion studies. One of these, which is now in the course of preparation, consists of a condensed motion picture to analyze the effects of the formation of clinker in the fuel bed of an underfeed stoker. By the simple expedient of taking single pictures at regular intervals, the entire tests of the stoker with the changes in the conditions of the fire are being analyzed and studied in detail. In this manner it is possible actually to watch the growth of a



Interior of Anthracite Institute Laboratory Showing Losch Stoker and Boiler in Foreground

clinker formation and to study its effect upon the general condition of the fire. This is extremely difficult in any other way as changes are so slow that it is almost impossible to determine with any degree of exactness the factors which influence the fuel bed.

The practicability of the laboratory lies to a great extent in its ability to duplicate heat conditions which would actually be found in your customers' cellars. Several steps have been taken to insure such a result. Tests on equipment released by the laboratory include not only the engineer's discussion of the efficiency of the equipment, but also take into consideration such practical details as the interference with radio, the ability to operate the heater during a power failure, the results which may be expected with different sizes and types of coal, the amount of clinker which may be expected, the appearance of the machines, the probable amount of noise, and the service attention which will be required.

Present work of the laboratory includes a variety of equipment ranging from ash handling machinery to automatic stokers. Preliminary tests have been completed upon a specially designed suction type of ash receiver. In the latter, connection is made to the cellar by means of flexible lengths of hose carried on the truck. Preliminary tests indicate that in instances where ready access may be had to cellars containing dry ash, a rate of removal of one cubic yard in ten minutes may be maintained. As this offers possibilities of both saving, cleanness, and convenience in the removal of domestic ash, studies are now being conducted to obtain further data, and to develop the truck to a point where it will receive moist ash and even small clinkers in all cellars encountered.

In addition to the removal of ash from the cellar, studies are being made of various methods of removing ashes from beneath the boiler, including the development of a mechanical device of the laboratory's design for shaking the grates of any furnace to exactly the correct point.

Another problem which the laboratory hopes to solve is that of automatic feed to the stoker hopper from the coal bin. The major difficulty is that there is no average basement and consequently no average distance from the bin to the hopper.

It has been stated that, in the order of their importance, the problems to be met in making anthracite a completely automatic fuel are: 1, removal of the ash from the can to a point outside the building; 2, feeding the coal from the bin to the hopper, and 3, removing the ash from a point outside the building to the point where it is disposed.

Uses of Cork in Heating and Ventilating Work

Due to its resistance to liquid penetration, its compressibility, low thermal conductivity, and other characteristics, cork is having a wide application in the heating and ventilating field.

In oil burners, for example, cork gaskets are used in fuel oil strainers. A cork seal is used to prevent leakage in the atomizer which sprays oil into the burner. A cork float in the oil chamber of the oil-burning stove and in the control valve regulates the flow of fuel. Cork inserts on the legs of oil burners prevent leakage and reduce vibration. Cork bushings are used in the valves.

In air heaters cork gaskets prevent a singing noise on high speed motors when used between the fan and fan plate attached to the motor.

Anywhere from pipe lines to radiators and from thermostats to draft balancers cork may be found. Upright waste line pipe sections which expand after installation use special cork gaskets with a binder which is soluble in water. When the pipes expand, the gaskets disintegrate, leaving room for pipe expansion and preventing breakage and costly repairs.

Other cork gaskets are used on brass drain pipe connections of electric sinks. Others are found at the top and bottom of radiators and at the base of heating elements in steam heating systems. In aluminum draft balancers cork makes tight seals between surfaces that are irregular.

Use of cork for insulation purposes is one of its best known and most important applications. Cork is used in making insulating brick for boiler settings, furnaces, and ovens.

Corkboard applied to the roofs of manufacturing plants reduces heat loss and keeps ceiling temperatures higher and more uniform, thus lessening moisture condensation and eliminating ceiling drip where high humidity has to be maintained. Corkboard is also used on the roofs of all kinds of buildings to insure greater heating efficiency for the upper floors during the colder months, and to keep the heat out in summer.

Still another use for insulating purposes which is finding increasing applications in the heating and ventilating industry is in the form of cork pipe covering for insulating brine and ammonia lines and other cold lines. Cork cold line insulation has found wide use in the oil refining and chemical industries.

One of the important applications in which the resiliency of cork is utilized is the deadening of noise and vibration of machinery. Machinery isolation is made of cork granules, compressed into boards and processed so as to insure uniform density and quality. It is firm yet very resilient and does not take a permanent set; it is readily cut with a saw or knife.

This cork "cushion," inserted under the base of an air compressor, blower, engine, fan, motor, or other machinery, protects both the machinery and the building structure by absorbing jar and vibration. For heavy machinery the entire concrete foundation is sometimes set on cork to isolate it from the building structure. The cost is very low.

"Ventilation of Farm Barns"

The ventilation of barns is an important consideration in the maintenance of the health of stock and in the preservation of hay, grain and barn timbers. In the ventilation of dairy barns it is highly desirable to maintain a comfortable stable temperature with a proportionately low relative humidity. The limits of temperature and humidity should always be compatible with good ventilation. Good circulation with consequent dilution of the impurities of the air is essential, but the comfort of the animals should be considered as well as the purity of the air. It is better to have good ventilation than to attempt to maintain a high stable temperature without ventilation.

The determination of the relationship of the factors affecting the ventilation of barns and having an important effect upon the economic and efficient design of farm buildings was the object of investigations conducted by the Division of Agricultural Engineering of the United States Department of Agriculture in cooperation with the committee on farm building ventilation of the American Society of Agricultural Engineers and several state agricultural engineering experiment stations, the results being reported in Technical Bulletin No. 187 entitled "Ventilation of Farm Barns," recently released by the department.

A description of the tests conducted precedes chapters on the amount of carbon dioxide allowable in stables and barns, the effect of moisture on the structure and on the animals, climatic conditions affecting construction, wall construction and insulation factors affecting operation and efficiency of ventilation systems, and determination of flue sizes.

Author, M. A. R. Kelley, associate agricultural engineer, Division of Agricultural Engineering, Bureau of Public Roads. Size 6 in. x 9 in. Pp. 74. For sale by the Superintendent of Documents, Washington, D. C. Price 25c.

Pipe Welding Specifications and Standards

*as Approved by the Heating and Piping Contractors National Association**

Specifications and standards covering the welding of piping were approved at the annual meeting of the Heating and Piping Contractors National Association last June. However, since that time the Sub-Committee on Welding has revised these specifications, and the material here presented contains all the revisions. The arrangement is identical with that which will be followed in the welding manual of that organization.

At the 41st annual convention of the Heating and Piping Contractors National Association the Specifications and Standards Covering Workmanship, Design and Construction of the Welding of Steel and Wrought-Iron Pipe were approved by the association. These standards were prepared by the Educational Department of the association in cooperation with the Sub-Committee on Welding and the Editorial Committee on the Standard Manual on Pipe Welding.

The complete specifications and standards which follow embody the revisions which have been made since their adoption by the convention.

SCOPE

1. These specifications cover the requirements for fusion welding (both the oxy-acetylene and electric arc processes) of all steel and wrought-iron piping, both standard and extra heavy weight, plain or galvanized, for steam and process piping operating at pressures not exceeding 250 lbs. (gage pressure) and at temperatures not exceeding 406° F.

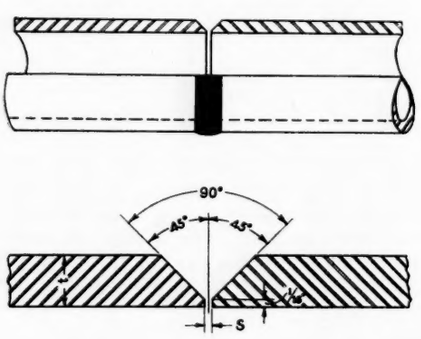


Fig. 1. Single V-Type Joints

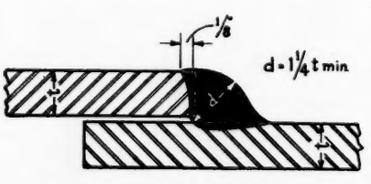


Fig. 2. Fillet Weld

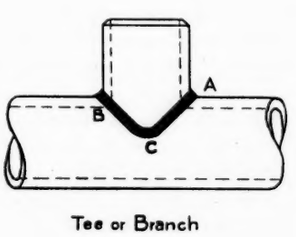
PURPOSE

2. The purpose of these specifications is to regulate and standardize the application of fusion welding in the piping industry, provide economical and uniform methods of weld tests, and to recommend and control the design and materials only in so far as they may be affected by the use of fusion welding.

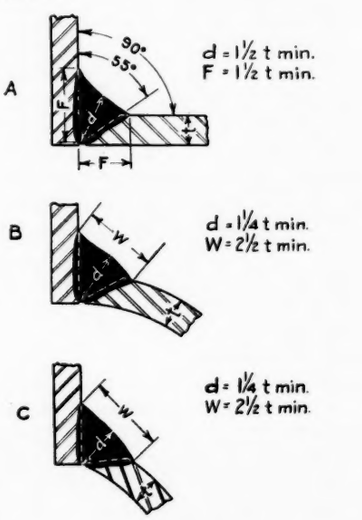
Materials and Apparatus

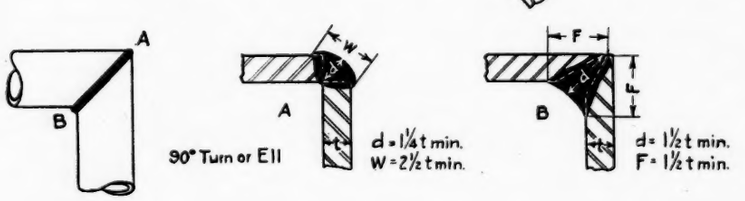
PIPE

3. The pipe shall be commercial grade of good weldable quality, free from defects, conforming to the requirements of the Standard Specifications of the American Society for Testing Materials as follows:



Tee or Branch





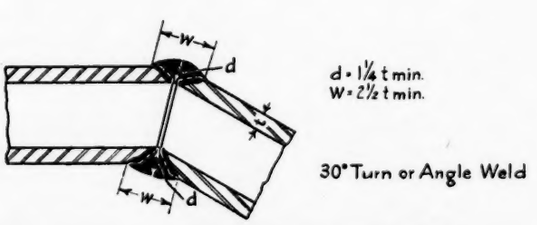


Fig. 3. Tee or Angle Joints

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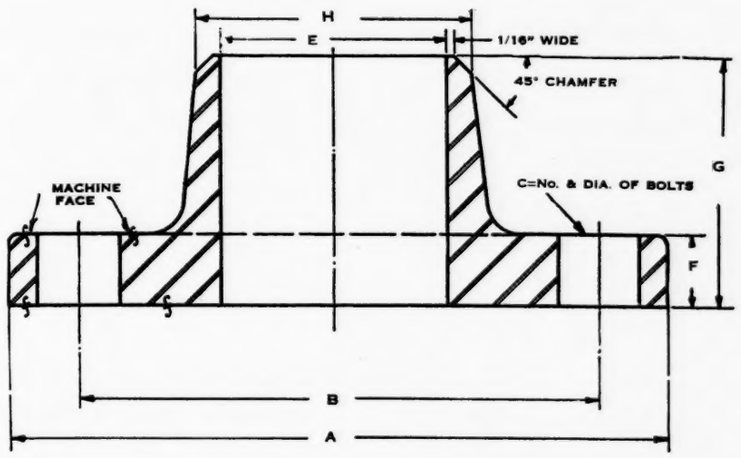
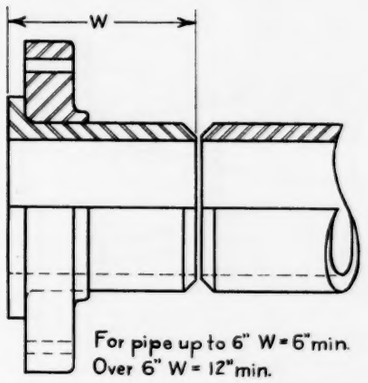




Figs. 4 and 5. Flanges

A—Welded Wrought-Iron Pipe—A 72-27.
B—Welded and Seamless Steel Pipe—A 53-27.
C—Lap-Welded and Seamless Steel Pipe for High Temperature Service—A 106-29.

The pipe shall not be split, bent, flattened, or otherwise injured, either before or after installation.

Pipe beveled for welding may be so purchased, or it may be beveled in the field.

FLANGES, FITTINGS AND BENDS

4. All flanges to be attached by welding shall be made of forged steel complying with the material requirements of the American Standards Association specifications B 16e—1927, and unless otherwise specifically required, shall be the Standard Welding Neck Flange of the Heating and Piping Contractors National Association. Reducers, branch connections, and other welding fittings including pipe bends and turns whether manufactured or fabricated from pipe by cutting and welding, shall be made from similar pipe material or seamless tubing complying with requirements of paragraph 3.

WELDING ROD

5. Low carbon welding rod shall have a chemical composition as follows:

Carbon .....not over 0.06 of 1%
Manganese ....not over 0.15 of 1%
Phosphorus ....not over 0.04 of 1%
Sulphur .....not over 0.04 of 1%
Silicon .....not over 0.08 of 1%

Low-carbon steel welding rods shall develop a tensile strength of not less than 45,000 lbs. per sq. in. cross section of the metal deposited in the weld. Special steel welding rods of good weldability and giving a tensile strength greater than 45,000 lbs. per sq. in. may be used if desired.

Note:—For all sizes standard pipe and for extra heavy pipe up to 6 in. size, 3/16 in. diameter welding rod is recommended. For extra heavy pipe above 6 in. size, ¼ in. diameter welding rod is recommended.

Workmanship

GENERAL QUALIFICATIONS AND REQUIREMENTS OF WELDERS

6. All welding shall be done by competent welders and in a thoroughly first-class, workman-like manner. No welding operator shall be permitted to weld on the piping installation covered by these specifications until he has proven satisfactory experience and certifies as having fully complied with the qualification tests herein provided.

7. At the discretion of the owner or his duly authorized representative, each welder may, in addition to, or in lieu of certification report, be tested in the presence of the owner or his duly authorized representative and required to pass the qualification tests listed and provided for in paragraphs 34, 35, 36, and 37 of these specifications.

8. Tensile strength test provided for in paragraph 37 may be given in lieu of the bend test in paragraph 36 if desired.

DESIGN OF WELDED JOINTS

Design—General Scope

9. It is the general purpose of these specifications to standardize and control only the form, design, procedure, and extent of the weld metal deposition. The diversity of construction and design which have been used and may be developed for connecting pipe lengths, branches, flanges and fittings would make it inadvisable to needlessly limit the general design of these parts, but unless otherwise specified, the various fittings and units of construction listed herein as standards shall be followed as representing the present best known and reliable practices.

NOMENCLATURE OF JOINTS

10. The types of welded joints and units of construction used in piping systems covered by these specifications are:

A. Single vee-type joints.—See Fig. 1.
B. Fillet welds—See Fig. 2.
C. Tee or angle joints—See Fig. 3.
D. Flanges—See Figs. 4, 5.
E. Bends—See Figs. 6, 7, 8, 9.
F. Reducers—See Figs. 10, 11.
G. Pipe headers—See Fig. 12.
H. Pipe caps—See Fig. 13.

Single Vee-Type Joints

11. All welded-line pipe joints shall be of the single vee type as illustrated in Fig. 1 and described under weld dimensions. Pipe in standard lengths should be purchased mill beveled or may be machine beveled to 45° to within 1/16 in. (± 1/32 in.) of the inside pipe wall.

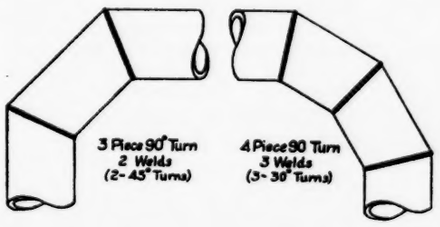
12. Odd lengths and tie-in joints may be cut and beveled with the cutting torch, and such cuts shall be regular and the finished bevel shall conform closely to the dimension requirements of the single vee-type joint provided for in these specifications. Before welding, all pipe surfaces cut and beveled with the cutting torch shall be properly cleaned of all oxide and unnecessary roughness by grinding, filing or other suitable means.

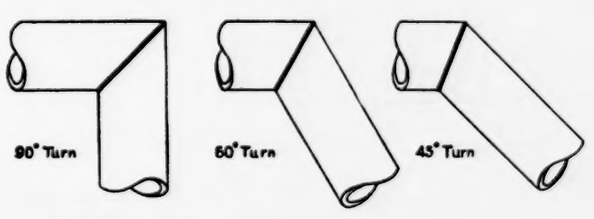
Single Vee-Type Weld Dimensions

13. The single vee-type weld shall have the following minimum dimensions:

Width:—2½ times pipe wall thickness.

Reinforcement:—Approximately 1/16 in. above outside pipe wall for pipe wall thickness up to ⅜ in.; and approximately ⅛ in. for greater wall thickness.





Figs. 6 and 7. Bends

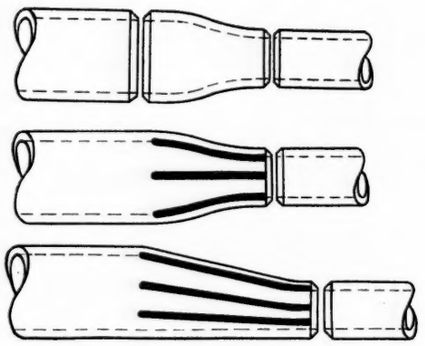


Fig. 10. Reducers

Penetration:—Fusion shall extend down and into unbeveled edges or shoulder of pipe ends, as illustrated in Fig. 1.

Shape:—There shall be no valley either at the edge or at the center of the joint and the weld shall be built up so that the weld metal will present a gradual increase in thickness from the surface of the pipe to center of the weld.

Note: Girth seams of double-length line pipe, machine-welded at the mill, are not required to conform to the foregoing specification for reinforcement.

Spacing and Tacking

14. The abutting pipe ends for line joints shall be separated and tack-welded for proper alignment in accordance with minimum requirements given in the following tables for standard and extra-heavy pipe:

TABLE IX
STANDARD PIPE

Pipe Size In. Diam.	Spacing Between Pipe Ends In.	Number of Tack Welds for Proper Strength and Alignment	Average Length of Tack Welds In.
½	1/16	2	¼
¾	1/16	2	¼
1	1/16	2	¼
1¼	1/16	2	¼
1½	1/16	2	¼
2	1/16	2	⅜
2½	1/8	2	⅜
3	1/8	4	½
4	1/8	4	½
5	1/8	4	½
6	3/16	4	⅝
8	3/16	4	⅝
10	3/16	4	⅝
12	3/16	6	¾
14	3/16	6	¾
16	3/16	6	¾

TABLE X
EXTRA-HEAVY PIPE

Pipe Size In. Diam.	Spacing Between Pipe Ends In.	Number of Tack Welds for Proper Strength and Alignment	Average Length of Tack Welds In.
½	1/16	2	¼
¾	1/16	2	¼
1	1/16	2	¼
1¼	1/8	2	⅜
1½	1/8	2	⅜
2	3/16	2	½
2½	3/16	4	½
3	3/16	4	½
4	3/16	4	⅝
5	3/16	4	⅝
6	1/4	4	⅝
8	1/4	6	¾
10	1/4	6	¾
12	1/4	6	1
14	1/4	6	1
16	1/4	6	1

FILLET WELDS

15. Fillet welds, where required for the fabrication of pipe hangers, supports, unbeveled plates, etc., shall be made as shown in Fig. 2 and comply with the following minimum dimensions:

Throat thickness—1¼ the minimum pipe wall or plate thickness.

Fusion Width—Fusion zone of junction between weld metal and base metal shall be equal in length in each direction to 1½ times the minimum pipe wall or plate thickness.

Shape—The contour of the weld shall be such that the hypotenuse of right angle triangle formed at the junction of the parts welded will give required throat dimension or convex outward and shall be symmetrical without valleys or low spots.

TEES OR ANGLE JOINTS

16. Tee or angle joint welds used in welding branch connections and fabricated bends shall be made so as to comply with the following requirements:

Beveling—The edges of the pipe shall be beveled and prepared so as to give well-matched intersections and permit fusion and deposition of weld metal to the bottom of the intersecting surfaces.

Spacing—The abutting edges of the intersecting parts shall be separated a sufficient distance to provide for contraction during welding and specified deposition of weld metal. A minimum spacing of 1/16 in. to ⅛ in. will be provided for tee connections and angle turns.

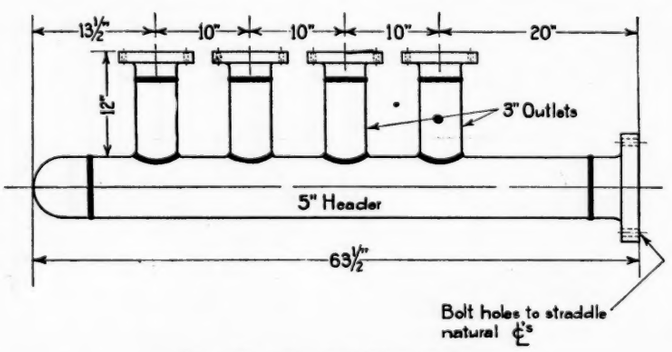


Fig. 12. Typical Pipe Header

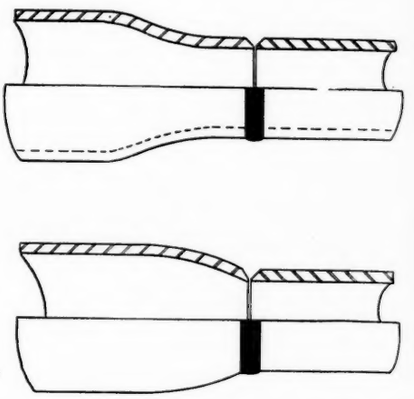


Fig. 11. Formed Reducers

Weld Dimensions—Where the angle formed between the intersecting parts is 90° or less, the throat or weld depth of the fillet weld shall be 1¼ times the minimum pipe wall thickness. The fusion length between weld metal and base metal shall be equal in length in each direction to 1½ times the minimum pipe wall.

Where the angle formed between the intersecting parts is 90° or more, the throat or wall thickness shall be 1¼ times the minimum pipe wall thickness. The width of the weld shall be a minimum of 2½ times the minimum pipe wall thickness.

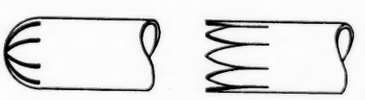


Fig. 13. Fabricated Pipe Ends

Weld Shape—The weld shape shall be symmetrical to the intersecting or welded parts and shall have no valley or low spots to weaken the weld or base metal. Fig. 3 illustrates the dimensions and shape of tee and angle joint welds for various angles of intersection of welded parts.

FLANGES

17. Flanges, wherever possible, shall be the Standard Welding Neck Flange of the Heating and Piping Contractors National Association (see Fig. 4.) If it is desired to use lap joint flanges (see Fig. 5) or other special flanges suitable for welding under these specifications, their use shall be permitted by mutual agreement between the owner and/or his duly authorized representative and the contractor.

Welded Fittings and Bends

18. Short-radius fittings (Fig. 6) especially designed for welding with beveled ends, of a radius equal to one and one-half times the nominal pipe size, and with substantially uniform wall thickness and true circular cross-section, made from seamless tubing equal to at least the pipe strength, may be used. The welds shall be made as specified in paragraph 13.

19. Bends fabricated from pipe (Fig. 7) may be welded for all pipe sizes. They shall be prepared to give well-matched intersections and uniform-flow characteristics and welded according to requirements specified in paragraph 16.

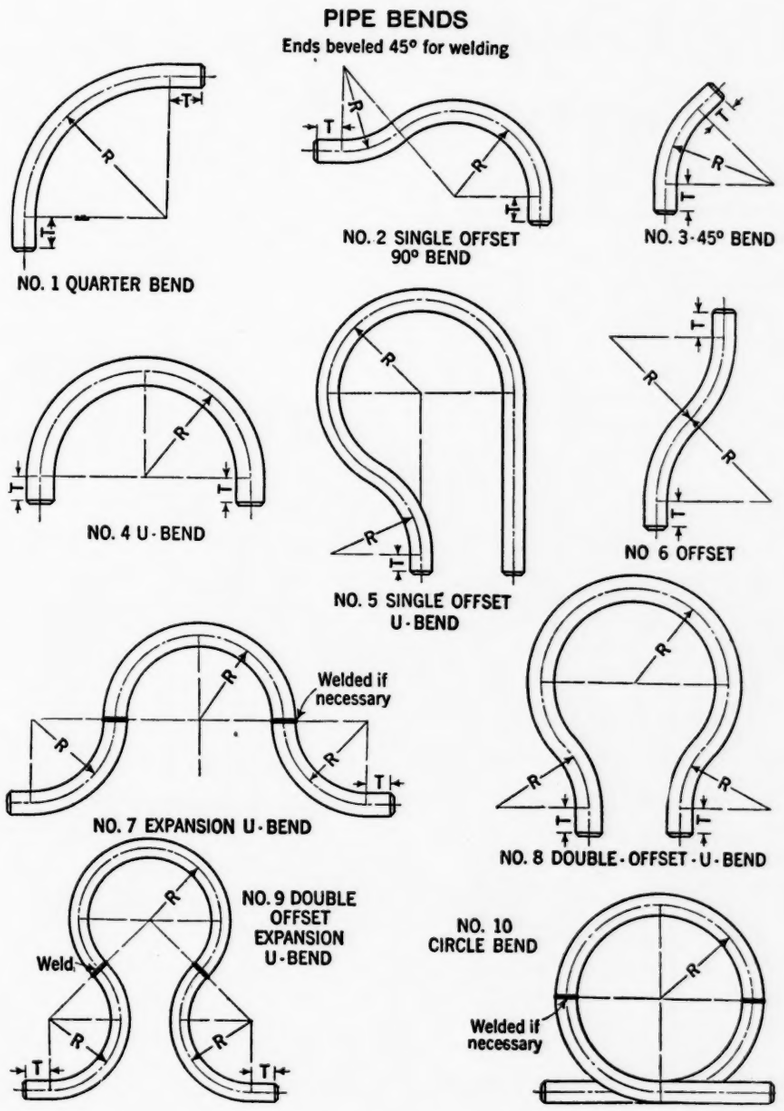


Fig. 8. Pipe Bends

20. Various typical and special long-radius pipe bends, as shown in Fig. 8, having ends beveled for welding may be used.

21. Bends may be formed by heating the pipe with the torch and bending to shape. Such bends shall not be formed to a radius less than five times the pipe diameter and must have no visible thinning, buckling or flattening.

22. Notched bends (Fig. 9) may be fabricated from pipe and used in sizes less than 8 in. nominal pipe size. All welds shall be made as specified in paragraph 16.

Swages or Reducers

23. Swages, or reducers, shall either be formed swages designed for welding to the piping or fabricated from pipe as shown in Fig. 10. Fabricated swages, wherever possible, shall be made at the end of the larger pipe so as to eliminate the weld at large end of swage. The preparation and welding shall conform to the requirements specified for welds in paragraphs 11, 12, 13 and 14. The length of the swaged portion shall be not less than the diameter of the pipe.

24. Swages, or reducers, formed by heating with torch, swaging and welding, as shown in Fig. 11, may be used for pipe size 3 in. and smaller for any reduction and for pipe sizes up to and including 8 in. when the reduction is not greater than two nominal pipe sizes, as 8 in. to 6 in. or 6 in. to 4 in. Such reducers shall be swaged so as to be smooth and symmetrical.

Headers

25. Headers, unless otherwise specified, shall be fabricated by welding, employing welded tee connections, as specified in paragraph 16, and welded directly to supply and branch lines.

Flanges, where required for attachment to boilers and apparatus, should be constructed as specified in paragraph 17.

Welded Pipe Ends

26. Fabricated pipe ends shown in Fig. 13, unless otherwise specified, shall be used for pipe sizes larger than 8 in. for all pressures covered by these specifications.

The concluding sections of the H. & P. C. N. A. Pipe Welding Specifications and Standards will be presented in next month's issue. They are devoted to "Construction" and "Tests."

Harry M. Dix

Harry M. Dix, heating and ventilating engineer with the Providence, R. I. office of the American Radiator Company, died suddenly at his home, 11 Elmwood St., Worcester, Mass., on September 14. Mr. Dix, who was a member of the American Society of Heating and Ventilating Engineers, was in his 46th year at the time of his death.

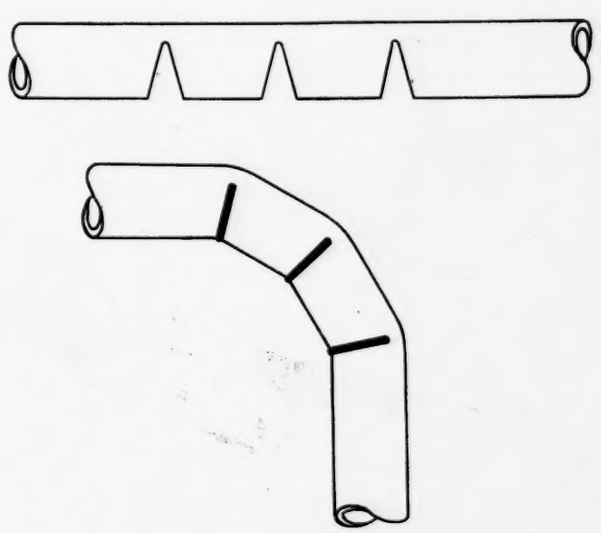


Fig. 9. Notched Bends

Gas-Fired Air Conditioning Unit in Baltimore Bank

by **EUGENE D. MILENER**
Industrial Research Representative, American Gas Association

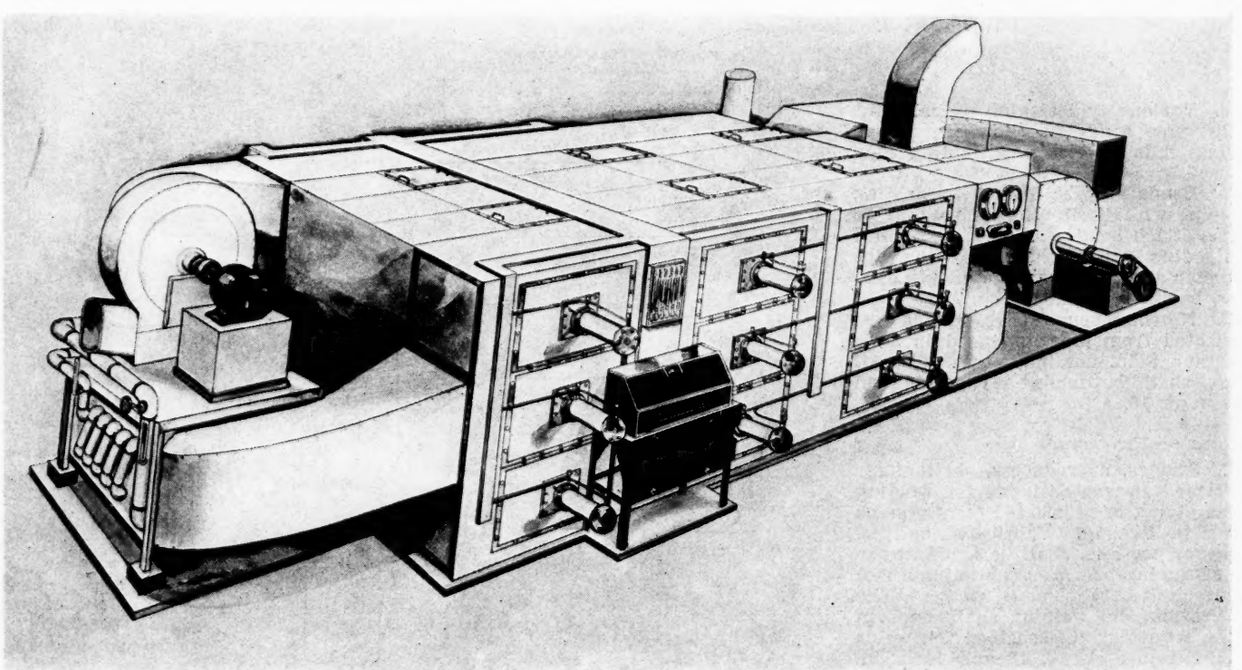
An entirely new system for cooling buildings, which costs less to operate than those now in use, has been perfected and installations made. This new cooling system, with a very slight change, can be made into a combination unit which will cool a building in the summer and heat it in the winter.

This system has been developed by the Silica-Gel Corp., Baltimore, Md., which company has been cooperating for some time in this development with the Committee on Industrial Gas Research of the American Gas Association. Briefly, the principle is to remove the sensible heat from the air in various coolers and the moisture in Silica-Gel beds, this moisture being driven out of the beds later by gas heat.

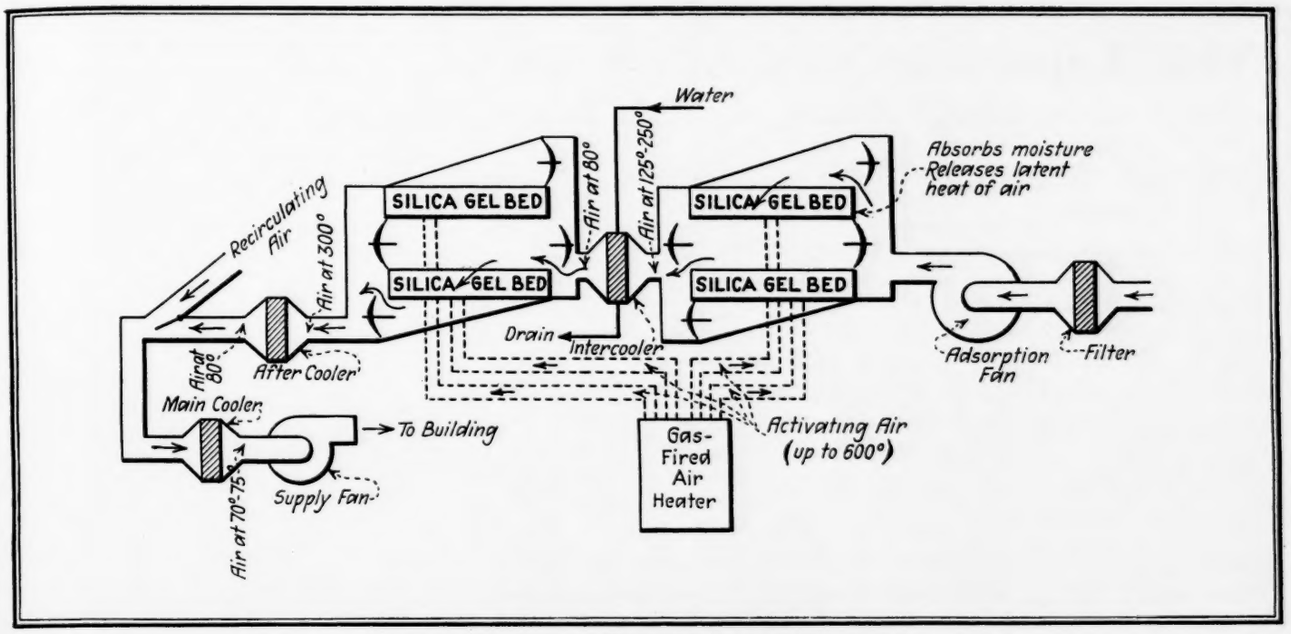
An installation of one of these new systems has been recently made in the Safe Deposit and Trust Company Building*, also of Baltimore, and it has proven entirely successful. The cooling and air conditioning equipment was installed by the Silica-Gel Corporation and the gas burner equipment by the Consolidated Gas, Electric Light and Power Company of Baltimore. Reeder, Eiser and Aker were the consulting engineers. The system consists of several units, most prominent among which is the steel box containing the three Silica-Gel beds. This box is about 15 ft.

Safe Deposit and Trust Building, Baltimore, Md.

*It is interesting to note that this building is next door to the Furness-Withey & Company Building, probably the first large office building in the United States to be heated with gas.



Gas-Fired Air Conditioning Unit



Schematic Diagram of Silica-Gel Air Conditioning Unit

long, 4 ft. wide and 4 ft. high. Air is first pulled through an automatic air filter which removes all suspended dust, particles, etc., and supplies clean air to the adsorption fan. This adsorption fan furnishes the necessary pressure to drive the cleaned air through one of the Silica-Gel beds.

This bed adsorbs all of the moisture from the air but in so doing it releases the latent heat of evaporation and the air leaves the bed at from 125° to 150° F. according to the moisture content of the fresh air. From the Silica-Gel bed the heated air passes through an intercooler consisting of a steel tank containing finned water coils through which tap water flows. In this intercooler the temperature of the air is reduced to 80°.

The air is now forced through another of the three beds which is still hot (about 300°) as it has just been activated, and any remaining moisture removed. As it leaves the second bed the air is about 300°, and to cool it, it is forced through an aftercooler where the temperature is reduced to an average of 80°. This aftercooler is identical to the intercooler in design and construction.

A certain percentage of moisture is necessary, however, and to obtain this, air is pulled from the building and mixed with this "bone dry" air and the exact ratio obtained. This mixture is then passed through the main cooler, which is similar to the other two coolers, where it is cooled to 70° or 75°. This prepared air, which contains the proper amount of moisture and correct degree of temperature, is taken by another supply fan and introduced into the building.

In explaining this process it might be well to state that the three beds are used on an intermittent cycle, the operating periods varying from a half to an hour. During these cycles two of the beds act as adsorbers as previously explained while the other is being activated or dried. After these two operations have been completed then the valves or dampers are automatically shifted so that one of the beds that has been adsorbing is now activated, and so on.

The term activation, as here used, means drying out, and this process is accomplished by passing heated air through a bed that has just been acting as adsorber and is now saturated with moisture. This hot air picks up this moisture and is vented to the air, leaving the bed dry and ready to be re-used as an adsorber again. The period of adsorption is twice that of activation and therefore two of the beds are used as adsorbers while one is being activated.

The air used in activating is heated in a gas-fired furnace to about 350° prior to being forced through the beds. The furnace, or air heater, is constructed of sheet steel, heavily insulated and lined with refractory material. It is about 8 ft. x 6 ft. x 7 ft. high. Baffles are placed in the heating chamber to properly mix the hot products of combustion with the fresh air. Heat is supplied by a single gas burner firing directly into the heating chamber. A nozzle mixing blast burner is used, air being furnished at 3 oz. pressure and gas at 4 in. of water. A fan blower supplies the air at this pressure.

In case the pilot light should go out, for any reason, a safety device is used which automatically cuts off the main gas supply. This consists of a sealed brass tube containing a liquid and the expansion of this liquid, acting on a piston, causes a valve in the gas line to close.

This particular air conditioning system supplies 7500 cu. ft. of bone dry air per min. to the building with an average gas consumption of 2000 cu. ft. of 500 B.T.U. gas per hr. The cubical content of the building is about 875,000 cu. ft. The only other power requirement is a small amount to drive the air through the beds and coolers. The cycle is continuous and automatic and the control is accomplished through motor-driven cams which open and close the dampers through the intermittent operations of pneumatic pistons. The cycle periods are controlled with a time clock.

The proper activation temperature is regulated by a thermostatically-controlled solenoid valve in the gas supply line to the furnace and a chart of this is kept by a recording pyrometer.

Silica-Gel has the same chemical analysis as sand (SiO_2) but physically it is highly porous and it is this physical characteristic which makes it valuable as an adsorber. It is made from sodium silicate (water glass) and sulphuric acid.

Radio Program Sponsored by Minneapolis-Honeywell

A thirteen-week radio program by the Minneapolis Symphony Orchestra over the Columbia Broadcasting System of twenty-two stations, will be sponsored by the Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. This orchestra, under the direction of Henri Verbrugghen, broadcast their first weekly program on Monday, September 8.

New Apparatus and Appliances

Automatic Turbine Driven Unit Heaters

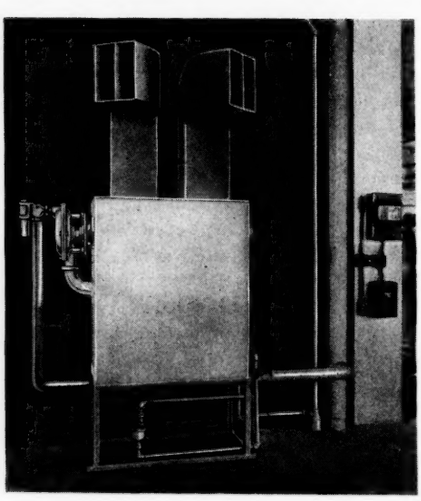
A line of steam turbine-driven unit heaters has been announced by the Automatic Turbo Heater Co., 343 South Dearborn St., Chicago, Ill. The units are of the high velocity multi-fan type designed for either high or low-pressure systems and can be supplied in either floor or ceiling types. The turbine rotor is mounted directly on the blower shaft, eliminating the necessity of flexible couplings and turbine bearings.

Each unit is equipped with thermostatically-controlled valve. Coils are of copper with mechanically attached spiral fins. Ball bearings are employed.

Operation of the unit is extremely simple. Steam from the mains is led directly from the turbine inlet where a small portion of its heat is abstracted to develop the power to drive the fans. The steam is then exhausted directly to the coils where it is condensed.

Advantages claimed for the turbine heater include the saving of electric power cost, saving in initial electric installation and simplicity of the unit.

Turbine heaters are made in five sizes in both floor and ceiling types, with capacities ranging from 198,000 to 1,120,000 b.t.u. per hr.

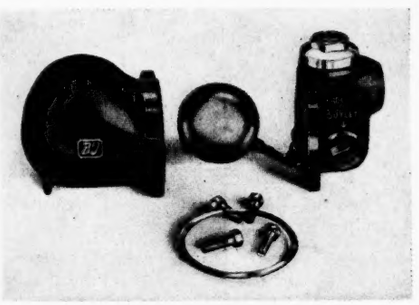


Automatic Turbo Heater

Barnes & Jones Blast-Drip Trap

Small and compact, yet with an extremely large capacity, a blast-drip trap has been announced by Barnes & Jones, 128 Brookside Ave., Boston, Mass. It is designed for use on drips from supply mains, unit heaters, returns from water heaters and blast heaters. Although intended for vapor and vacuum installations, it is also applicable to systems with steam pressures up to 15 lbs. which should not be used where a pressure exists on the discharge side of the trap.

The unit, which weighs 15 lbs., is a combination float and thermostatic trap having a float-controlled valve governing the discharge of water and a thermostatically-controlled valve which allows a discharge of air but prevents the passage of steam. It has capacities ranging from 500 lbs. of condensation per hr. at ½ lb. per sq. in. pressure difference, to 1850 lbs. at 15 lbs. pressure difference.



Barnes & Jones Blast-Drip Trap

Temperature Regulator for Homes

Automatic Heat Regulator Co., 2655 W. Harrison St., Chicago, Ill., announces a low-priced all-electric temperature regulator for coal, coke or gas furnaces, steam or hot water systems.

The thermostat operates on the bimetallic principle. The regulator which operates the check damper and draft door consists of a metal, one-piece Sylphon bellows with a vertical bulb, filled and sealed under a vacuum with a liquid which is remarkably sensitive to temperature changes.

Nichrome resistance wire is wrapped around the bellows bulb. When the room temperature drops below the temperature for which the thermostat is set the thermostat closes an electrical contact, causing electricity to flow through the resistance wire. The heat produced raises the temperature of the liquid in the bulb, and causes the bellows to expand and move the lever which opens the draft door and closes the check damper. The retail price on the automatic regulator, complete with a special transformer, thermostat, pulleys and chain, is $48 installed.

Purgo Boiler Cleaner

A boiler cleaner, sold under the name of Purgo, has been placed on the market by the Liquid Veneer Corp., 375 Elliott Ave., Buffalo, N. Y. The manufacturer states that the cleaner is compounded to remove grease, rust, slime, sludge, lime and magnesia from the boiler water passages. Five pounds of crystals are used for systems having from 300 to 600 sq. ft. of radiation. Over this, 1 lb. is added for each 150 sq. ft.

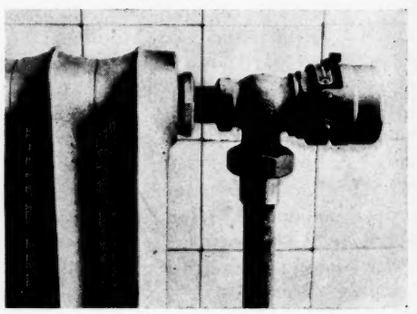
By means of an injector sold by the company, the cleaner may be injected into the boiler through drain plugs, without drawing off the water or lowering the steam pressure.

Radiatherm Thermostatic Radiator Valve

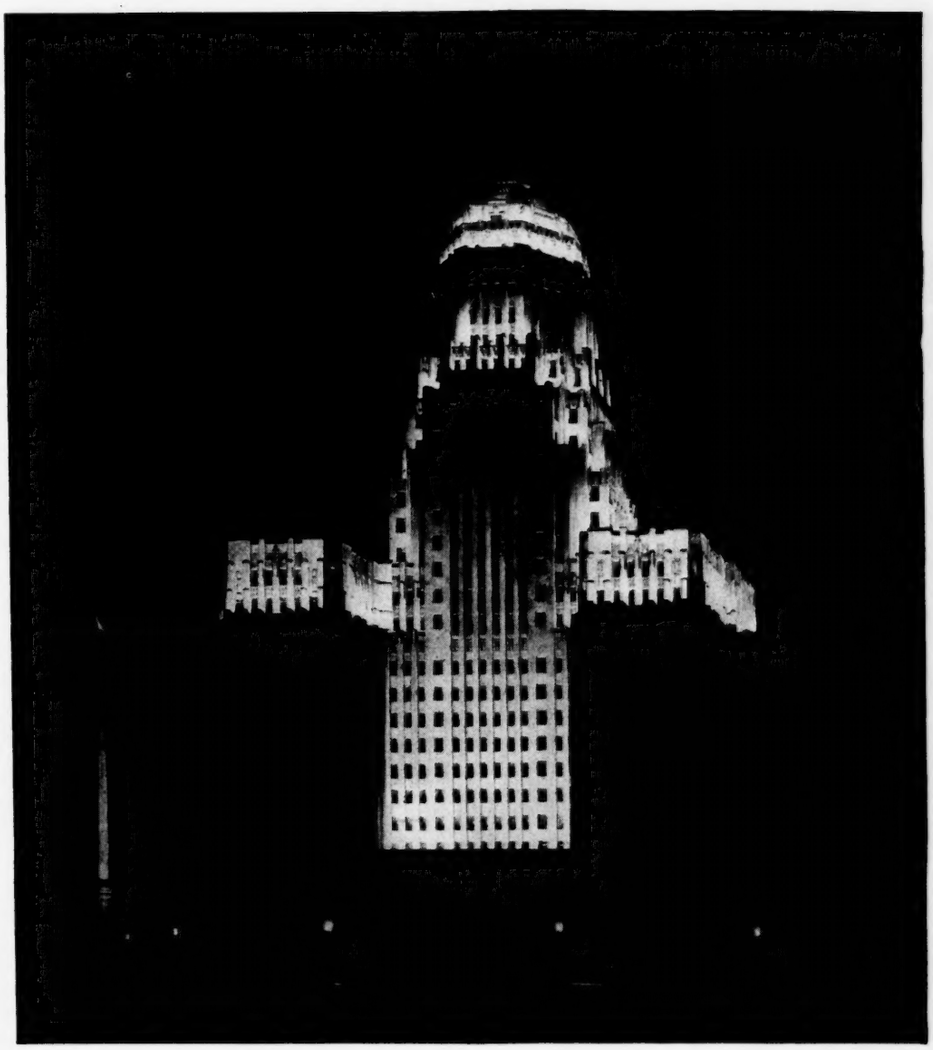
American Radiator Company, New York, has placed on the market the Radiatherm, a simple thermostatic device for automatically and individually controlling the steam supply to each radiator on two-pipe systems.

This device effects independent and automatic temperature control for each room. As long as an adequate heating system is in operation, individual room warmth is uniformly maintained at a desired temperature.

It is claimed that the Arco Radiatherm makes possible considerable economies in fuel because it maintains the temperature at a predetermined constant regardless of changes in pressure of outside temperature. The radiation of a building is figured to take care of the coldest winter weather. Given ample steam supply, it is easy to heat satisfactorily during the relatively few days of the year when the full capacity of the radiator is required. The difficult part to handle, however, is during the greater portion of the heating season when the weather is mild and when overheating is so objectionable and wasteful. During this period only a very small portion of the radiator is required to hold the temperature at 70°. The Radiatherm sees to it that only that much of the radiator is heated, and so saves a great amount of fuel.



Radiatherm Radiator Valve



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Buffalo, N. Y.
Sullivan W. Jones
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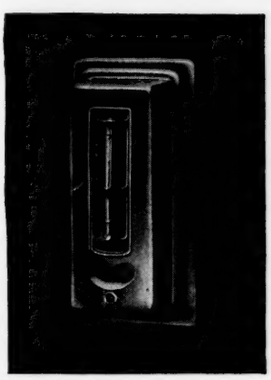


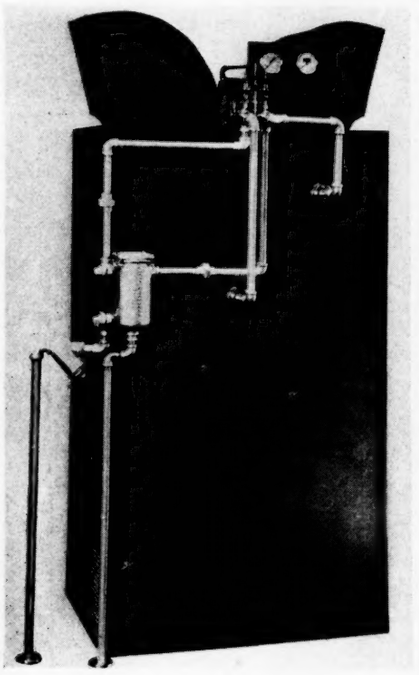
Powers Thermostats Are Better

Because—they need no annual adjustments or overhauling—have no fine restrictions to become clogged by dirt—are no larger than others, but thermostatic element is larger—therefore more sensitive and powerful.

POWERS

General Regulator Industrial Type Air Conditioning Unit

An industrial air conditioning unit has been announced by the General Regulator Corp., Kolmar and Grand Aves., Chicago, Ill.



General Regulator Industrial Type Air Conditioner

Built within a self-contained cabinet are self-cleaning spray heads for atomizing the water, eliminator plates and temperature changing radiation in the circuit with refrigerating machine and heating boiler. These units are all contained within a copper housing. To the inlet opening of this housing is connected the outlet duct of a blower. Ahead of the blower intake is a removable air filter section.

Water to spray heads passes through a strainer and a copper coil type spray water preheater up to a bellows-type valve. A steam or hot water line passes into spray preheater and thence up to a second bellows-type valve. Both the water and steam or hot water bellows valves are automatically opened by an electric motor.

In the motor circuit is a hygrostat, placed at a remote point within the plant or space to be conditioned. The hygrostat is in dual connection with a thermostatic element to control the refrigeration unit. Indicating instruments such as wet bulb temperature steam and spray water pressures are optional accessories.

A modified form of this same unit can be used with a duct system leading from the basement of large residences to first and second floors above.

Truck for Handling Radiators and Heavy Equipment

Little Giant Mfg. Co., 1927 Nicollet Ave., Minneapolis, Minn., is manufacturing the Little Giant radiator truck which will lift a weight as heavy as half a ton. It will handle a 4-col., 45-in. radiator, and also a 13-in. wide window radiator.

The truck consists of a main arch 4 ft. 7 in. in height, which forms the center support for two bars of 3 ft. in length, across which is placed a center drum, to which is geared a crankshaft. Across each end is a shaft with two loose pulleys over which the chain or cable passes. The wheels are 5¾ in. in diameter, with a wheel base of 13½ in. Handles are bolted both to the center arch and the rear supports of the carrier bars. These supports are rods extending from the rear end of the bars to the base block, while like supports also extend from the forward end of the bars to the base block. The truck weighs 193 lbs.

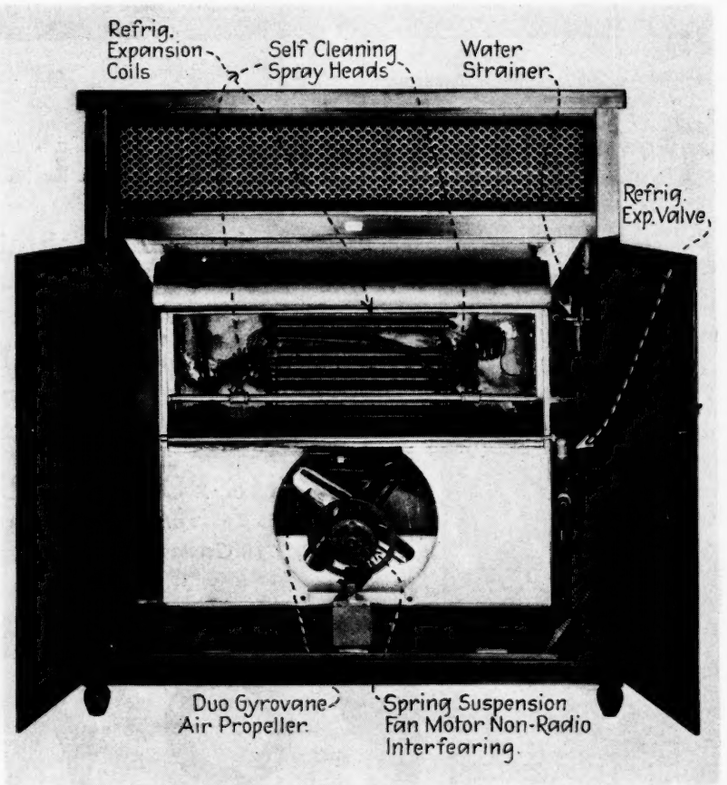
With the radiator in an upright position the truck is pushed to a position straddling the radiator. The chains suspended from both the front and rear pulleys are then hitched about the radiator, and the radiator hoisted into position by cranking the windlass. The cross pieces between the carrier bars act as stabilizers for the radiator, preventing any swing or shifting of balance. One man is required to operate the truck. The wheels are equipped with rubber tires so as not to mar finely finished floors.

General Regulator Corporation Residence Air Conditioning Unit

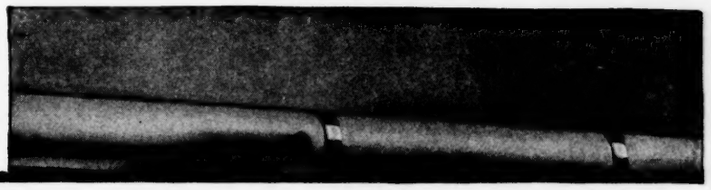
An air conditioning unit for residences in which radios are housed has been placed on the market by the General Regulator Corp., Kolmar and Grand Aves., Chicago, Ill.

The unit has an all-copper receptacle, comprising self-cleaning spray heads for washing the dust and cooking odors out of the air and properly humidifying it. It is also equipped with the especially designed Duo-Gyrovane fan, the blades of which comprise special slots which, when revolving, produce a positive suction of air from the back and distribute uniformly all over the blade area, from hub to tip, a current of air without noise or hum.

Fully automatic control may be incorporated with the cabinet using a solenoid valve and a hygrostat basically covered in the company's patent 1,294,074 and others pending. Refrigeration control of this cabinet comprises an American Radiator expansion valve and Mercoid thermostat. Humidity control comprises a General Regulator hygrostat and American Radiator solenoid valve.



General Regulator Domestic Air Conditioning Unit



You don't have to baby Asbestocel

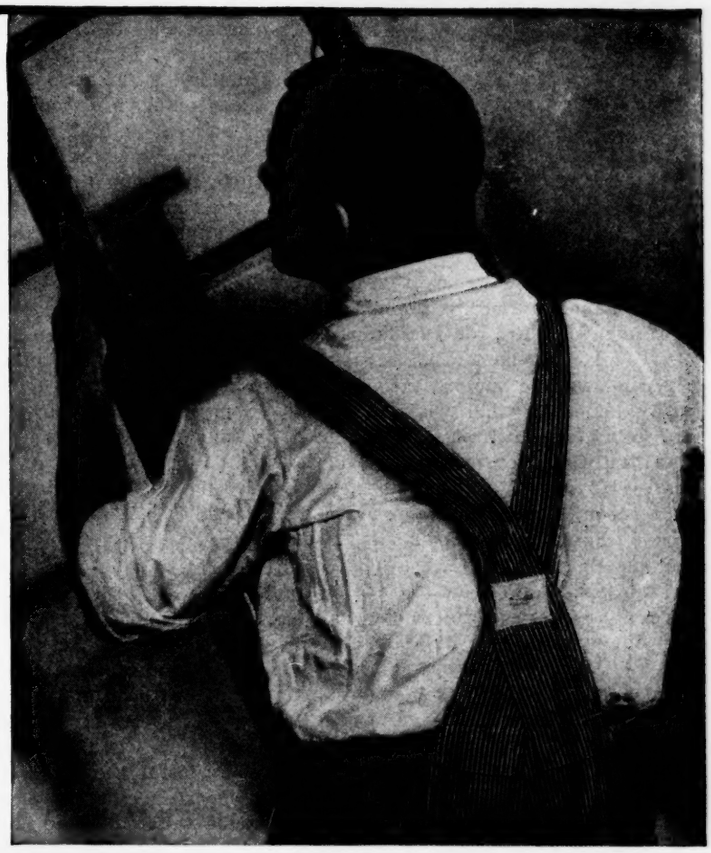
It is Made to Stand Up Under Rapid Handling

ONE look at an actual piece of Asbestocel would convince any plumber that this improved pipe covering can be counted upon to make a neat job without having to handle it with kid gloves. Even an accidental bang from a stepladder, or a ten foot drop to the floor will not damage Asbestocel because it is made more than strong enough to give a lasting, first class job.

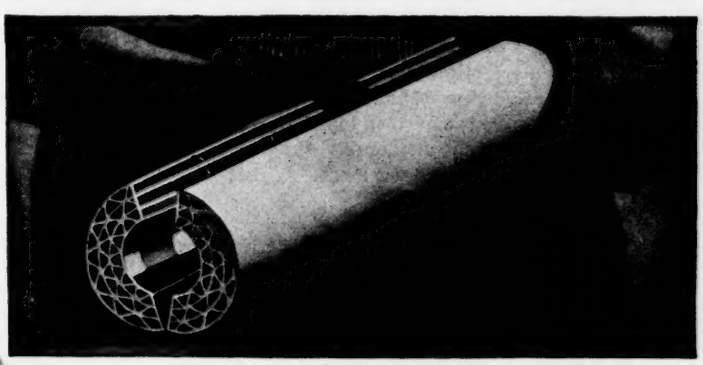
Remember every section of Asbestocel is perfectly designed to save money for you and your customers. Every piece of Asbestocel is of uniform length, roundness and thickness. It is straight-lined and clean-cut. It snaps shut like a book over the pipe and fits firm and smooth for all time. Asbestocel makes a job of which you can be proud.

Improved Asbestocel is a precision product, scientifically made for its work. The cross corrugations may seem a small matter. Yet they gain for Asbestocel two advantages which ordinary air cells lack. There are 8 to every 36 inch length. Thus there are 8 hips, or ridges, which add greater strength to the covering. In addition, by cutting the longitudinal air chambers into small cells the cross corrugations stop circulation of air within the insulation and greatly increase its effectiveness.

Thousands of contractors have learned the economy of figuring on Improved Asbestocel for their jobs. Try it on your next job. Let Improved Asbestocel speak for itself.



Note the cross corrugations shown in this close-up photograph. This construction is only found in "Improved Asbestocel."



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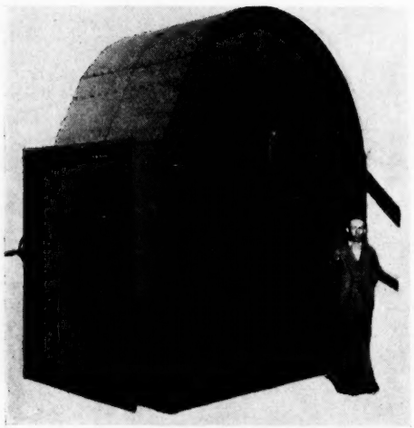


Clarage HSV Fan
Described in the August issue of Heating and Ventilating

Allen Ash Removal System

A portable ash removal system is being manufactured by the Allen Air Appliance Co., Inc., 452 Lexington Ave., New York. The apparatus is mounted on two separate motor trucks temporarily joined together while the ashes are being drawn from the basement. The first truck, or dump unit, carries the air-tight steel ash container, while the second, known as the power unit, carries the suction-producing apparatus and gasoline motor.

Two trucks are used to avoid the necessity of taking the power unit to the dump yard each time a load of ashes is moved. The power unit contains a 75 h.p. Continental motor operating a multi-stage vacuum producer, together with two large dust filters. Where the system is to be permanently used, a pipe line is installed extending from the ash pit to the sidewalk. The truck draws up to the pipe line outlet on the curb and makes a quick connection at the sidewalk level. The system has a capacity of two cans per minute.

The system can be used to clean boilers and furnaces, as well as remove the ashes. Use of this system eliminates the dust problem due to blowing of the ashes in the street when being removed and hauled away, and cuts down considerably the cost of removal from the basement.

Botfield Chromite Cement Developed

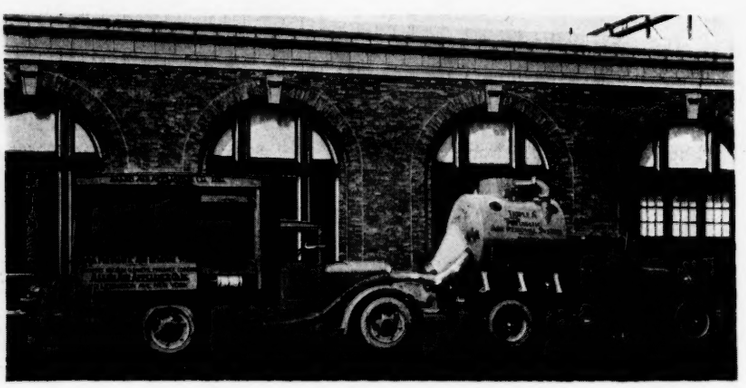
A new high temperature cement which will be added to its line of Ada-products and sold under the trade name of Adachrome Plastic Super-Cement, has been announced by the Botfield Refractories Co., Swanson and Clymer Sts., Philadelphia, Pa.

Because of its chromite base, Adachrome Plastic Super-Cement is chemically-inert, hard, dense and highly refractory. Furthermore, the new cement employs a bonding agent which is efficient at high temperatures.

Among the destructive furnace actions to which this new cement is resistant are basic and acid slags, molten metal penetration, abrasion, erosion and chemical reaction in the burning of acid sludge. In addition, the material, when applied as a surface coating on boiler settings, protects the brickwork from the penetrating action of clinker and fusible coal ash. The cement is sold in plastic form, ready for use without mixing prior to use. The material is suited for making either dipped or troweled joints. Two sizes of drums, 250 lb. and 500 lb. are available.

Kelly Safety Boiler Control

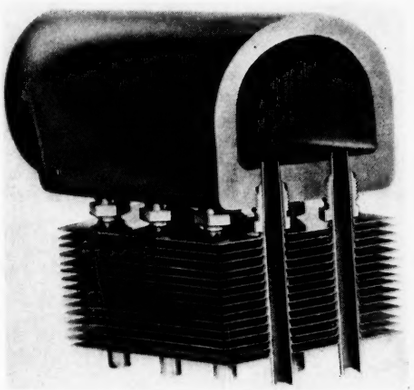
A low-water control specially designed for use with oil and gas burners, is being sold by the American Safety Boiler Control Co., Inc., Port Chester, N. Y. The control consists of a plug which is inserted in a tapping in the boiler at the water line, the plug being so designed that the cap which fits in the water can be unscrewed. Two wires form a junction on the inside of the plug, with a fusible cap on the end, so that when a high temperature is reached as the water line becomes too low, the junction melts and the electrical circuit to the two wires is broken, closing the oil or gas valve. The device is made in one model that fits any boiler.



Triple-A Ash-Removal System

Leak-proof Unit Heater

Strength, stamina and freedom from trouble are said to be characteristics of a unit heater recently introduced by the United States Blower and Heater Corp., Minneapolis, Minn.



Section of Heating Surface of Leak-Proof Unit Heater

Its condenser construction is exceptionally sturdy. The union between fins, tubing and headers is accomplished by a mechanical bond. There are no brazed nor soldered seams nor joints. This equipment is tested at 350 lb. hydrostatic pressure and withstands steam pressures as high as 200 lb.

Carborundum Company Makes Carboradiant Burner

A self-contained rotary type oil burner has been announced by The Carborundum Co., Perth Amboy, N. J.

The burner is made in three sizes, with heating capacities from 100 sq. ft. to 2000 sq. ft. of installed steam radiation. A rotating mixing chamber is mounted on an extended shaft of a 1/12 h.p. vertical motor. The design permits the vertical motor to be removed through the boiler door without disturbing the fire deck. The motor is oiled from outside of the ash pit of boiler. The fuel oil pump is mounted on a small base plate in front of boiler and is driven by a 1/12 h.p. motor.

Fuel oil is pre-heated in a chamber mounted around the shaft extension of the vertical motor. The radiant fire ring made of Carbofrax does not require sealing between the fire ring and the boiler wall. The air for combustion is delivered to the fire ring by a fan on the rotating mixing chamber. Each burner is equipped with dual safety controls consisting of safety stack switch and a safety trip bucket. The burner may also be operated with gravity system or with wall pump.

MONEL METAL

. . . gives to superheated steam lines the advantages of the Badger Expansion Joint.

INCO MONEL METAL

"My opinion is expressed in the use of over sixty (60) welding type expansion joints with Monel sleeves during the last two years and the use of this type of expansion joint on all mains constructed during 1929.

"The outstanding reasons for the use of these expansion joints are the elimination of packing costs, service interruptions caused by expansion joint maintenance and steam leakage."

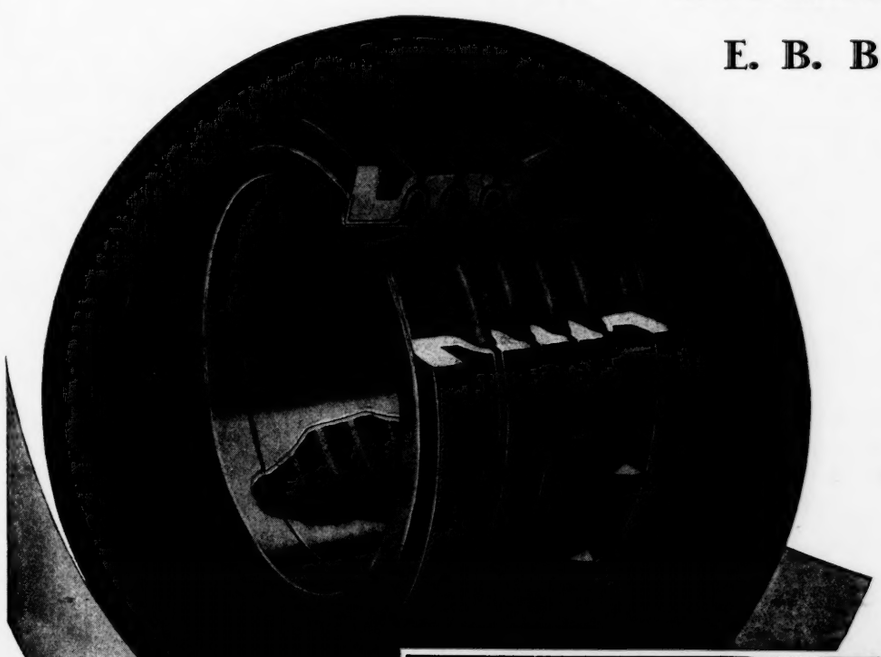
—from engineer of prominent central heating station.

STEAM, under ordinary conditions, has no ill effect on the special composition copper used in all Badger Self-Equalizing Expansion joints.

But superheated steam! For a time that was a problem. All kinds of flexible materials were tried. Sleeves of different metals were used.

Monel by far proved itself the best. While permitting, as was expected, the steam to get back of the sleeve and fill the chamber, it killed the destructive action of the superheat.

On many superheated steam lines Badger Expansion Joints are giving excellent, long-life service. Credit is due to Monel.



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Cincinnati, Ohio, Union Trust Bldg.
Cleveland, Ohio, Guardian Building
Detroit Mich., 402 Ford Building
Houston, Tex., 1308 Sec. Nat. Bk. Bldg.
Indianapolis, Ind., 823 Occidental Blg.
Kansas City, Mo., 1336 Oak Street
Los Angeles, Cal., 517 Hollingsworth Building
Minneapolis, Minn., 732 Build. Exch.
Montreal, Que., Can. Cement Bldg.
New Orleans, La., 419 Maritime Bldg.
New York, N. Y., 271 Madison Ave.
Philadelphia, Pa., 1500 Walnut St. Room 901
Pittsburgh, Pa., Union Trust Bldg.
Salt Lake City, Utah, Kearns Bldg.
San Francisco, Cal., Sharon Bldg.
Seattle, Wash., 415 Lenora Street
St. Louis, Mo., 3605 Laclede Avenue

BADGER EXPANSION JOINTS

Trade and Miscellaneous Notes

Coming Events

October 13-17, 1930. Twelfth annual convention and exhibition of the American Gas Association at Atlantic City, N. J. Headquarters at the Atlantic City Auditorium.

October 27-30, 1930. Fifty-ninth annual meeting of the American Public Health Association at Fort Worth, Tex. Headquarters at the Texas Hotel.

October 29-30, 1930. Thirty-sixth annual meeting of the Central Supply Association. Headquarters at the Palmer House, Chicago.

December 1-6, 1930. National Power Show at New York. Headquarters at the Grand Central Palace.

December 2-3, 1930. Mid Year Meeting of the National Warm Air Heating Association. Headquarters at the Deshler-Wallick Hotel, Columbus, O.

January 27-29, 1931. American Society of Heating and Ventilating Engineers Annual Meeting at Pittsburgh. Headquarters at the William Penn Hotel.

February 10-14, 1931. Fifth Midwestern Engineering and Power Exposition at Chicago, Ill. Headquarters at the Coliseum.

April 13-18, 1931. American Oil Burner Association Convention at Philadelphia. Headquarters at the Benjamin Franklin Hotel.

Garden City Fan Company Holds Elections

Garden City Fan Co., Chicago, Ill, announces the election of the following officers at its regular annual meeting of the stockholders: H. C. Richards, president; W. Gardner, Jr., vice-president and general manager, and T. J. Flanagan, secretary and treasurer.

Mr. Richards, with headquarters at Niles, Mich., has been vice-president of the firm for thirteen years and has been in charge of the manufacturing end for over twenty years. Both Mr. Gardner and Mr. Flanagan have been associated with the company for over twenty years. Their headquarters will be located in the McCormick Building, Chicago. E. D. Green, former president and treasurer, passed away on May 29.

Williams Oil-O-Matic Convention

Over 3000 oil burner dealers, salesmen, service men and representatives of allied heating lines attended the sixth International Oil-O-Matic Convention, held August 18-19 at the Williams Oil-O-Matic Heating Corporation's factory, Bloomington, Ill., representing every American state and Canadian province, Cuba, the Argentine and Australia. C. U. Williams, president of the corporation, made the address of welcome, and brief talks were made by other officers and department executives.

Features of Tuesday's sessions were talks by George Harms and Jack Stowell on the importance to each other of the warm-air furnace and the oil burner. K. E. DeRosay, fuel oil engineer of the Sun Oil Co., Philadelphia, spoke on the relative values of the different grades of domestic heating oils. Many other important and interesting talks were included on the program for both days.

Held in connection with the convention, an exposition of heating apparatus and allied equipment, covering the exhibits of more than 30 manufacturers, was an important feature.

Manufacturers' Notes

Reliance Electric & Engineering Co., Cleveland, O., manufacturers of alternating and direct current motors, announces the promotion of James S. Fenton to the position of sales engineer of the New York office.

Monash-Younker Co., Chicago, Ill., manufacturers of steam specialties, whose New York office is now 67 West 44th Street, is celebrating its 40th anniversary this year under the direction of its president, Charles P. Monash. Louis P. Monash, who has been in charge of the New York office for over 30 years, continues as manager. Associated with him is Edward A. Muller, who has been connected with the New York office for over 25 years.

Wells-Newton National Corp., New York, announces the election of the following officers: President, Henry J. Martin of Dallas, Tex.; vice-president and treasurer, William P. Kirk of Bridgeport, Conn.; secretary, William Haas of Dayton, O.; vice-presidents, R. Carter Beverley of Richmond, Va.; Dick Johnson of Champaign, Ill., and George Mitchell of Baltimore, Md.

"X" Laboratories, New York, announces the appointment of William J. Mitchell as Sales Manager of the Plumbing and Heating Division. Mr. Mitchell was formerly New York manager for the Borden Co., Warren, O.

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., announces the opening of a branch office at 218 East Washington St., Syracuse, N. Y., under the management of Kenneth Sprague. This office will take over the distributorship carried on for many years under the name of Frank Sprague, Kenneth Sprague's father.

Charles C. Phelps, manufacturers' agent, 11 Park Place, New York, has been appointed sales agent for Metropolitan New York and Northern New Jersey by the Leavitt Machine Co., Orange, Mass., to handle the Dexter valve reseating machine for globe, gate and pump valves.

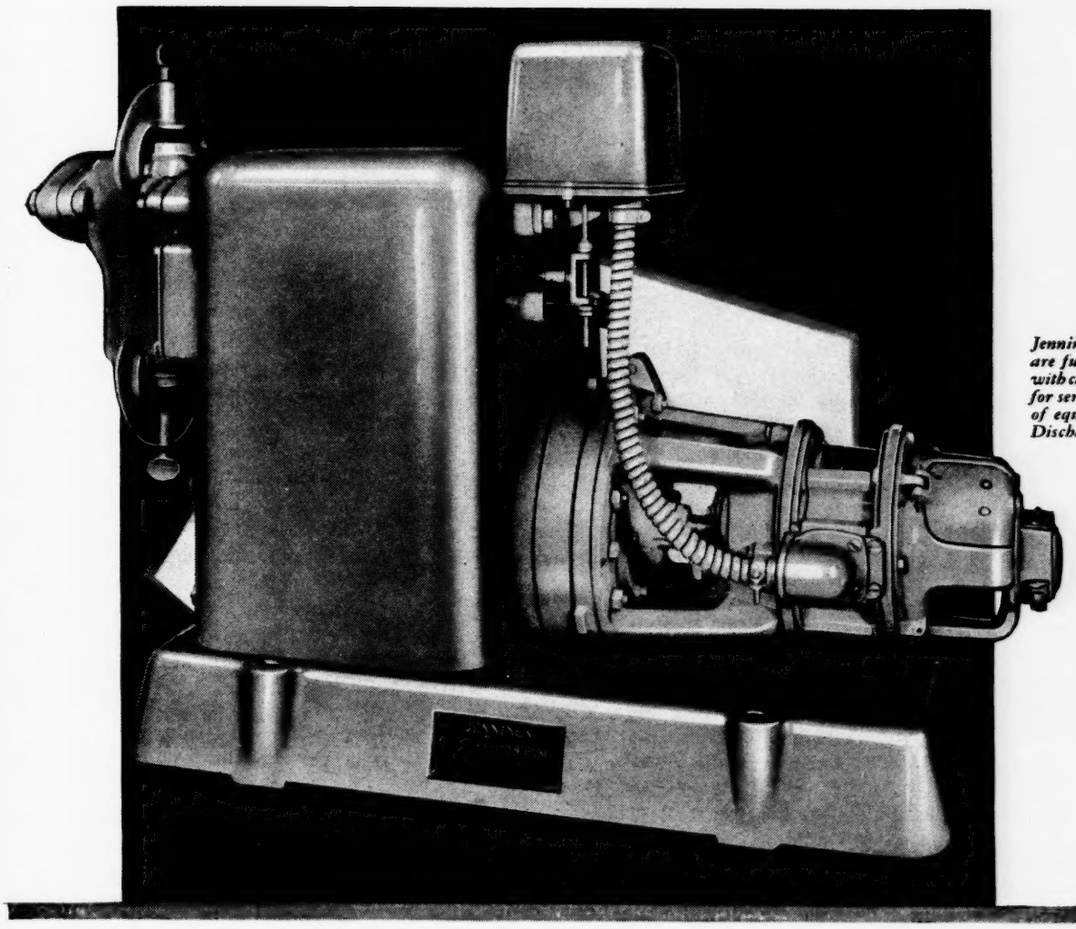
Brown Instrument Co., Philadelphia, Pa., announces with regret that George W. W. Cornman, treasurer and manager of the Service Department, retired from business on August 8. Mr. Cornman has been associated with the instrument business for 35 years, formerly being secretary and treasurer of the Keystone Electrical Instrument Company. When that organization was absorbed by the Brown Instrument Company, he became treasurer and a director of the present organization.

The Service Department will be in charge of R. C. Kennan as manager, and E. T. Nahill as Field Supervisor.

Murray Iron Works Co., Burlington, Ia., manufacturers of steam turbines, engines and boilers, announces the following appointments of selling agencies for its products: William Stairs, Son & Morrow, Ltd., Halifax, Nova Scotia, Canada, and Mathews & Co., 734 Brookhaven Drive, Orlando, Florida.

Jas. P. Marsh & Co., Chicago, a division of the Commercial Instrument Corp., announces the appointment of M. A. Cooper as district sales representative with headquarters at New Orleans, La., and E. L. Aikins of the Marsh Sales Company as district representative for the states of Washington, Oregon, Montana, Idaho and British Columbia. The Marsh company manufactures heating systems and units, industrial instruments, automatic air valves and gauges.

McDonnell & Miller, Chicago, Ill., announces the appointment of William J. Boales as assistant sales manager in their Detroit territory, with offices in Detroit. Mr. Boales was formerly assist-



Jennings Condensation Pumps are furnished in standard sizes with capacities of 4 to 200 g.p.m. for serving up to 150,000 sq. ft. of equivalent direct radiation. Discharge pressures up to 60 lb.

Assures unobstructed flow of steam

through radiators below boiler water line

Radiators located below boiler water line, are automatically kept clear of condensation by the Jennings Condensation Pump.

Simply and sturdily constructed, the Jennings Condensation Pump combines receiving tank, pump and driving motor in a single, compact assembly. The centrifugal impeller is mounted on a short extension of the motor shaft . . . no flexible coupling is required. Pump casing is cast as an integral part of the tank . . . there is only one stuffing box. The rigid bracket which supports the motor insures perfect and permanent alignment of shaft and working parts independent of the base.

The Jennings Condensation Pump will give years of trouble-free, economical service. Write for bulletin 99. The Nash Engineering Co., 81 Wilson Road, South Norwalk, Conn.

Jennings Pumps

ant sales manager for the Hoffman Specialty Company.

The Ric-wiL Co., Cleveland, O., manufacturers of underground pipe conduit systems, announces that C. W. Lemmerman and Carl Harrington have severed business relations with their company. The New York office of this company, located at 101 Park Avenue, is now under the direction of H. A. Wicks.

Pierce, Butler & Pierce Mfg. Corp., 41 East 42nd St., New York, manufacturers of boilers and radiation, announces the opening of a Chicago office and branch warehouse at 3638 West 38th St., Chicago. This branch, which is under the management of Mr. A. H. Jolliffe, will carry a complete stock of Pierce boilers and Eastwood radiation.

Mineral Felt Insulating Co., Toledo, O., held its second annual sales convention, July 24-26. A large number of plumbing and heating contractors who are merchandising Mineral Felt products were present.

Fitzgibbons Boiler Co., 570 Seventh Ave., New York, announces that a substantial enlargement of the works on the shores of Lake Ontario in Oswego, N. Y., is now under way which, when completed, will provide a capacity for the production of 500 steel boilers at one time.

L. J. Wing Mfg. Co., New York, manufacturers of turbine and motor-driven blowers, featherweight unit heaters and Scruplex fans and exhausters, announces the appointment of the Harry G. Murphy Sales Co., 316 Union National Bank Bldg., Scranton, Pa., as sales representative for northeastern Pennsylvania.

Sarco Co., Inc., 183 Madison Ave., New York, manufacturers of Sarco heating specialties, steam traps and temperature regulators, announces the following changes in sales representatives:

F. W. Scheer, Andrews Bldg., Pearl & Court Sts., Buffalo, N. Y., has been appointed sales representative for western New York State as far east as Syracuse.

The Erie section of Pennsylvania has been turned over to the Cleveland office of Sarco Co., which is in charge of F. K. Minor, 805 Bulkley Bldg.

Williamson & Woody, 1138 Mutual Bldg., Richmond, Va., have been appointed sales representatives for the state of Virginia, with the exception of the extreme northerly portion.

Engineering Equipment Co., 209 Glenn Bldg., Atlanta, Ga., have been appointed sales representatives for the state of Georgia, with the exception of the coastal counties and the vicinity of Chattanooga, Tenn.

Stewart Roberts, 215 W. 7th St., Chattanooga, Tenn., has been appointed sales representative for territory conveniently surrounding that city.

Perfection Stove Co., Inc., Cleveland, O., announces the appointments of the following dealers to handle new Perfection oil burners: Round Oak Heating Co., Chicago, Ill.; D. M. Raiche, Kankakee, Ill.; Brake Service & Equipment Co., Youngstown, O.; Muza Sheet Metal Co., Oshkosh, Wis.; M. W. Lefevre, Long Island, N. Y.; S. C. Grimshaw, East Hampton, N. Y.; George T. Scheid, Lima, O.; Schlenker Hardware Co., Ann Arbor, Mich.; Richardson Electric Co., Inc., Westfield, Mass.; W. A. Snudden, Morristown, N. J.

Herman Nelson Corp., Moline, Ill., announces the appointment of J. S. Webb as manager of the New York branch, with offices at 25 West 43rd Street.

United States Blower and Heater Corp., Minneapolis, Minn., manufacturers of blowers, heaters, air washers, exhaust fans, humidifiers and other air conditioning equipment, announces the appointment of C. T. McGrew as sales manager. Mr. McGrew was formerly sales manager of the O. B. McC'intock Company.

National Steel Boiler Co., Johnstown, Pa., has been organized to take over the Lebanon Boiler Works, Inc. The company will manufacture welded steel firebox heating boilers for the National Radiator Corporation. Its general office will be located in Johnstown, Pa., at 221 Central Ave., and its plant in Lebanon, at 14th and Buttonwood Sts.

Officers of the company are: President, Samuel B. Waters; vice-president, Robert S. Waters; secretary-treasurer, Carl E. Resley; general manager in charge of manufacturing sales, William Heagerty. Samuel B. Waters and Robert S. Waters are both vice-presidents of the National Radiator Corporation.

Jas. P. Marsh & Co., Chicago, Ill., heating system manufacturers, announces the appointment of Col. W. H. Riblet as manager of the heating department of the New York office.

American Radiator Co., 40 West 40th St., New York, announces the appointment of W. G. Salisbury, formerly engineer of the Certified Heating Division of the Heating and Piping Contractors Detroit Association, as salesman connected to the Detroit office.

Pierce, Butler and Pierce Mfg. Co., New York, announces that Robert Feltwell has been appointed sales representative in Baltimore, Md. Mr. Feltwell formerly was connected with the D. & T. Mfg. Co.

Gorton Heating Corp., Garwood, N. J., announces the establishment of a new midwestern sales office in the Mather Tower, Chicago, under the direction of William O'Neill, Jr. This office will handle the sale of the company's single pipe vapor heating system and Surevent air valves in Illinois, Wisconsin and Indiana.

Bryan Steam Corp., Peru, Ind., manufacturers of Bryan copper tube oil and gas-burning boilers, announces the establishment of connections with the Santa Fe Builders Supply Co., Santa Fe, New Mex., for the distribution of Bryan boilers in that state.

Maise Corp., Detroit, Mich., announces the appointment of Lawrence L. Smith, former general sales manager of the Petroleum Heat & Power Co., Stamford, Conn., as vice-president and general manager.

Petroleum Heat & Power Co., Stamford, Conn., announces the appointment of H. W. Dexter as assistant general sales manager in charge of the sales organization handling Petro and Nokol oil burners and industrial equipment.

A. E. Hess has been appointed national service manager.

F. F. Hoyt has been appointed comptroller, succeeding L. E. Snowman.

Stanley H. Brown, recently district sales manager at the Chicago Nokol plant, has been transferred to the New York office to act as district sales manager for that territory.

Herbert E. Williams, Jr., recently head of Petro Oil Burner Corp., formerly New York distributors, has joined the Petro organization as district manager of the Greater New York territory.

J. H. Griffith, formerly New England sales manager, has been transferred to the home office at Stamford to assume the duties of divisional sales manager for both Petro and Nokol equipment.

Charles Van Maanen has terminated his connection with the company.

Grant Home Heater Corp., 123-7 Montgomery St., Jersey City, N. J., announces a change of the corporate name to Eastern Oil Burner Corporation.

Pittsburgh Equitable Meter Co., Pittsburgh, Pa., have recently opened a new plant in Los Angeles, Calif. A complete line of water, gas, oil and gasoline meters and pressure regulating equipment is carried in stock ready for immediate delivery. Any necessary repairs to equipment installed on the Coast can be made here. This plant is located at 1918 East 7th Street.

Changes of Address

Trane Co., Philadelphia Division, manufacturers of concealed heaters, unit heaters, specialties and pumps, has announced the removal of its offices to the new Terminal Commerce Bldg., 401 North Broad St., Philadelphia.

Staynew Filter Corp., 109 N. Water St., Rochester, N. Y., has moved to its new factory and home office at 25 Leighton Ave., Rochester.

Sage-Allen Department Store, Hartford, Conn. *Architects:* Dennison-Ethan-Allen & Associates, New York City and Hartford *Engineer:* Clyde R. Place, New York City. *Heating and Ventilating Contractor:* The Frederick Raff Co., Hartford.

Interesting Solution of
Heating *and* Ventilating Problem in Department Store . . .

TO heat and ventilate a good-sized store, and take up the least possible space with equipment . . . this was the problem encountered when Sage-Allen's store was remodelled. It was solved to perfection with six Sturtevant Unit Heater-Ventilators.

Not one square inch of floor or show-case space was sacrificed! Direct radiation was eliminated, and the Unit Heater-Ventilators placed up at the windows. From these vantage points, they not only ventilate . . . but heat . . . with greatest efficiency. Air is kept moving . . . and the temperature difference between floor and ceiling is much less than with direct radiation.

In the morning, salesrooms are quickly warmed up by *recirculated* heat. Then all day long the air is new, fresh, and inviting as the merchandise on sale. Outdoor air is drawn in...filtered...tempered...and passed indoors, without any draft or sound.

Sturtevant Unit Heater-Ventilators are adaptable to a wide variety of applications . . . in business houses, institutions, hotels, theatres, churches, schools. It's well worth a minute of your time to write for Catalog 361.

B. F. STURTEVANT COMPANY
Main Offices: HYDE PARK, BOSTON, MASS. CHICAGO, ILL., 410 No. Michigan Avenue, SAN FRANCISCO, CAL., 681 Market Street
Branch Offices in Principal Cities: Canadian Offices at: Toronto, Montreal and Galt. Canadian Representatives: Kipp Kelly, Ltd., Winnipeg. Agents in Principal Foreign Countries.

Sturtevant Unit Heater-Ventilator

Reg. U. S. Pat. Off.

SUPPLIES OUTDOOR AIR ~ FILTERED CLEAN ~ AND TEMPERED

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Advertisements under this heading, $2 per inch, payable in advance. A 1-in. advertisement contains about 35 words in this size type. Larger type and spacing at $2.00 per inch. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.
HEATING AND VENTILATING — 521 Fifth Ave., New York, N. Y.

FANS

EXHAUST AND VENTILATING

Airplane propeller type. Standard in four arrangements. Direct connected fans equipped with ball bearing motors; belt drive fans equipped with roller bearings. Single, double and multi-blades give wide range in volume, horsepower and pressure. Single and double high speed blades for industrial installations; slow speed multi-blade fans for quiet, efficient operation.

CENTRAL FAN MFG. CO.

1457 Chouteau Ave., St. Louis, Mo.

SALES REPRESENTATIVE WANTED—An excellent opportunity with unlimited financial possibilities, either as direct salesmen or as sales representatives, is offered, covering a complete line of vacuum, vapor and steam heating specialties, a complete system of temperature regulation, fans, air washers, and unit heaters. Only those with technical education and thoroughly experienced in one or more of the lines will be considered. Give complete history of selling experience with reference to territory covered, name of company now associated with, etc. Applications confidential.

THE BISHOP & BABCOCK SALES CO.
Cleveland, Ohio

The New York Blower Company requires successful and experienced fan and unit heater salesmen. For further information address The Sales Manager, 3155 Shields Avenue, Chicago, Ill.

—WANTED—

Manufacturer's Representatives

We have several openings for high class representatives to contact distributors and dealers, having exclusive selling franchises on the Wayne Oil Burner and Wayne Electric Refrigerators. Applicant must have successful record in sales together with sound engineering education. An unusual opportunity for men handling not in excess of two or three non-competitive lines. State full details of experience, territory desired and companies represented at the present time.

WAYNE
HOME EQUIPMENT CO.
FORT WAYNE, IND.

SALES REPRESENTATIVE WANTED — We have some desirable territories available for Sales Engineering Organizations who have entree to Architects, Mechanical Engineers, Contractors and Large Industrial Organizations. Address Box 127, care of Heating and Ventilating.

MEN WANTED

To fill larger positions or make larger opportunities in a Billion Dollar Industry, like Heating, Ventilating, Refrigeration, and Sanitary Engineering.

We have just revised and enlarged our unexcelled Home Study Courses. They are now brand new for 1930-31 men to use in carving out more steady work, larger positions, more income, etc. Men with ambition and anxious to get ahead will find these Courses just what they need to lead them into higher executive positions.

This is our 21st year Training Monarchs of the Trade. Let us include YOU in our Student body this Fall. Get your copy of our new Directory—it's free to men who want to get ahead. Entire satisfaction is guaranteed by our Instruction methods. Write Now, by checking your Course.

- ☐ **Heating, Ventilating and Refrigeration Engineering.**
- ☐ **Special Warm Air and Forced Air Heating.**
- ☐ **Steam and Hot Water Heating.**
- ☐ **Air Conditioning for Fan H. and Eng.**
- ☐ **Plumbing and Sanitary Engineering.**
- ☐ **Contracting and Estimating.**

The St. Louis Technical Institute
4543 Clayton Ave. ST. LOUIS, MO.

POSITION WANTED — Experienced engineer, heating, ventilating, air-conditioning, piping, etc. College man with practical experience. Registered heating and ventilating engineer. Address Box 126, care of Heating and Ventilating.

Have You Bought Your 1930 A. S. H. and V. E. Guide?

THIS year's edition was much larger than any previous one but the material in it has had such an unusual appeal that the supply is almost exhausted. *The Guide* is indispensable to those who want to keep posted on the latest developments in the field. It has over 1000 pages, 6 x 9 inches in size and is well illustrated. A glance at the chapters listed below will give some idea of its scope.

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Enclosed find $5.00 for one A. S. H. & V. E. Guide

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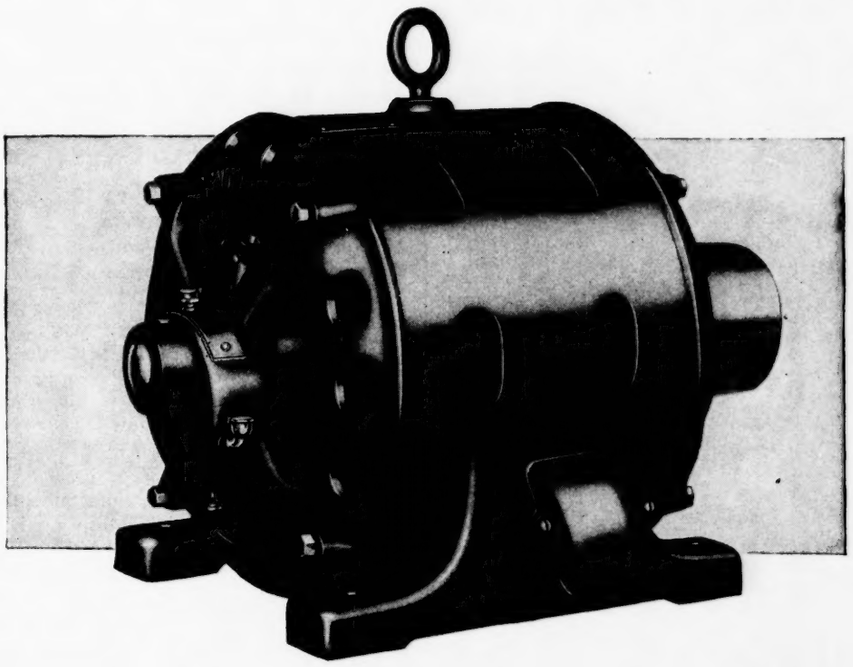
Bound in Flexible Fabrikoid, Only $5.00, Delivered

HEATING AND VENTILATING, 521 Fifth Ave., New York

THEY KEEP A-RUNNING



5 Horse Power Century Type RS Repulsion Start Induction Single Phase Motor.

FOR BLOWERS and FANS

The continuous "Keep a-Running" ability of Century Type RS Single Phase Induction Motors—plus their high starting torque and low starting current—makes them particularly suited for driving pumps, oil burners, blowers and fans . . . The brushes touch the commutator only while starting. They are liberally proportioned and well balanced in design—both electrically and mechanically. No one characteristic is over-developed at the expense of another . . . The sleeve bearings last. They are of phosphor bronze—the best bearing material obtainable—and are equipped with brass ring oilers extending into oil wells of generous capacity.

Built in all standard sizes from 1/8 to 40 horse power.

CENTURY ELECTRIC COMPANY
1806 PINE STREET · · ST. LOUIS, MO.
40 U. S. and Canadian Stock Points and More Than 75 Outside Thereof

SINGLE PHASE, THREE PHASE, AND DIRECT CURRENT MOTORS

Century MOTORS

MOTOR GENERATOR SETS, ROTARY CONVERTORS, FANS AND VENTILATORS

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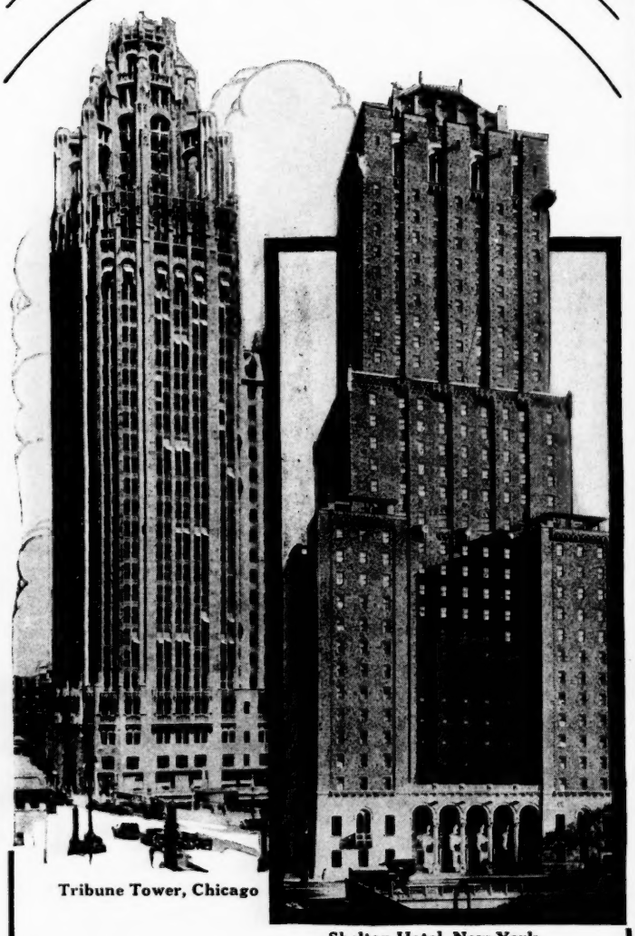
FOR MORE THAN 26 YEARS AT ST. LOUIS

AWARDED MEDAL of HONOR



Tribune Tower, Chicago

Shelton Hotel, New York

As a tribute to their creative genius, the Architectural League awarded the Medal of Honor in Architecture to Arthur Loomis Harmon, of Schreve, Lamb & Harmon, architects for the Shelton Hotel, New York; and to John M. Howells and Raymond M. Hood, architects for the Tribune Tower, Chicago.

It is significant that these architects should select Patterson Hot Water Heaters for these magnificent structures.

When you want to be sure of getting all the hot water required, as hot as required and as quickly as required, you'll find it safe to follow the example of these architects.

May we send you a catalog?

THE PATTERSON-KELLEY CO.
107 East 40th Street, NEW YORK, N. Y.

Patterson
Hot Water Heaters

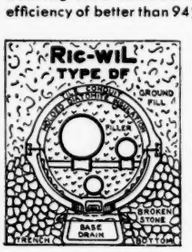
STEAM PIPE VIBRATION DOES NOT AFFECT RIC-WIL INSULATION

Cross section of Ric-WiL Type F Conduit with Dry-paC filler, single pipe installation. Note Base Drain carries the entire weight of pipe supports and pipe independent of the Conduit.

ENGINEERS generally agree that pipes carrying steam at high velocities vibrate continuously. For this reason the idea has prevailed that *any* loose insulating filler would settle. But Dry-paC, a patented waterproof insulating filler, will not settle as is demonstrated by the following test.

Top conduit section removed to show Dry-paC after installation. An official test of this underground steam heating line showed an efficiency of better than 94%.

To determine the effect of vibration on Dry-paC, ten feet of 2″ pipe was installed in Ric-wiL Type F Conduit and insulated with Dry-paC packed to standard density. One end of the pipe was fitted with a rocker arm which produced a longitudinal movement of $\frac{1}{16}$″ 160 times per minute. The pipe was thus vibrated for three 8-hour days —a total of 24 hours or 230,400 vibrations. We believe this pipe movement far exceeded any vibration found in actual installations.



Ric-wiL Type DF Conduit with Dry-paC filler, multiple pipe installation. Type DF has moulded diatomite insulation on inside of conduit.

Top halves of Ric-wiL Conduit were then removed one at a time and the Dry-paC was carefully examined. There was not a sign of settlement and the Dry-paC was just as firm as when first packed. Certainly such a test offers conclusive proof of the efficiency of Dry-paC insulating filler in Ric-wiL Conduit—it is another reason why so many Ric-wiL installations, insulated with Dry-paC, show better then 90% efficiency.

Write for photographs and a complete report on this test—satisfy yourself that there is no substitute for Ric-wiL Conduit Systems for underground pipes.

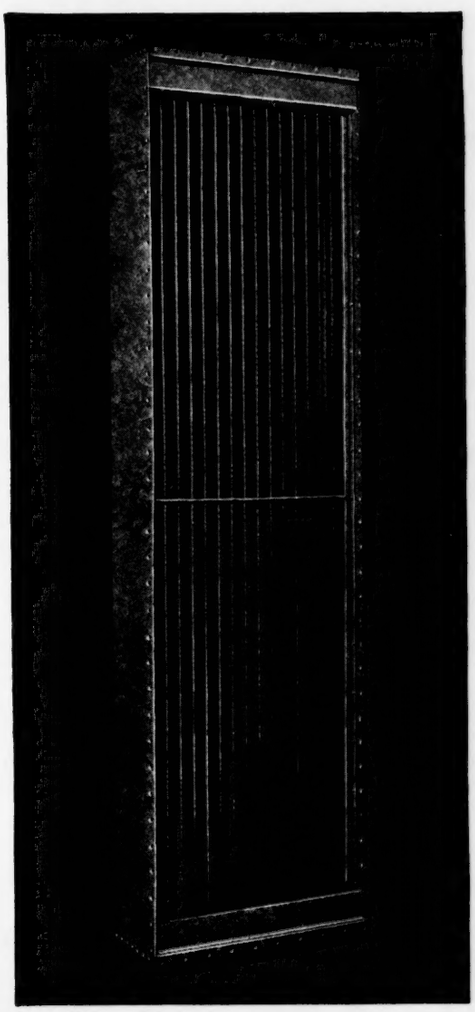
THE RIC-WIL COMPANY
1562 Union Trust Building . . . Cleveland, Ohio
Branches: New York • Baltimore • Atlanta • Chicago
AGENTS IN PRINCIPAL CITIES

REG. U. S. PAT. OFF

RIC-WIL
UNDERGROUND CONDUIT

ENCASED ARCOBLAST HEATERS

for the largest manufacturers of COMPLETE RADIO RECEIVING SETS



In the Spray-Booth Building of Grigsby-Grunow Company in Chicago, manufacturers of Majestic Radios, 6100 lineal feet of Arcoblast are supplying fresh air.

Here is another case where the high efficiency and light weight of Arcoblast make it the ideal radiation for perfect ventilation.

Heating Engineer—Martin C. Schwab, Chicago Heating Contractor—John R. Kehm Company, Chicago Fan Equipment — American Blower Company.

AMERICAN RADIATOR COMPANY

DIVISION OF

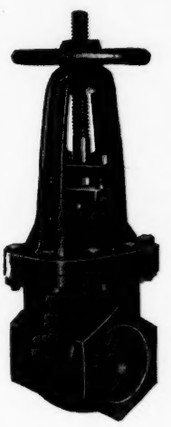
AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

816 So. Michigan Ave., Chicago 40 West 40th St., New York City

IRON BODY GATE VALVES

SCREWED, FLANGED
AND
HUB END STYLES

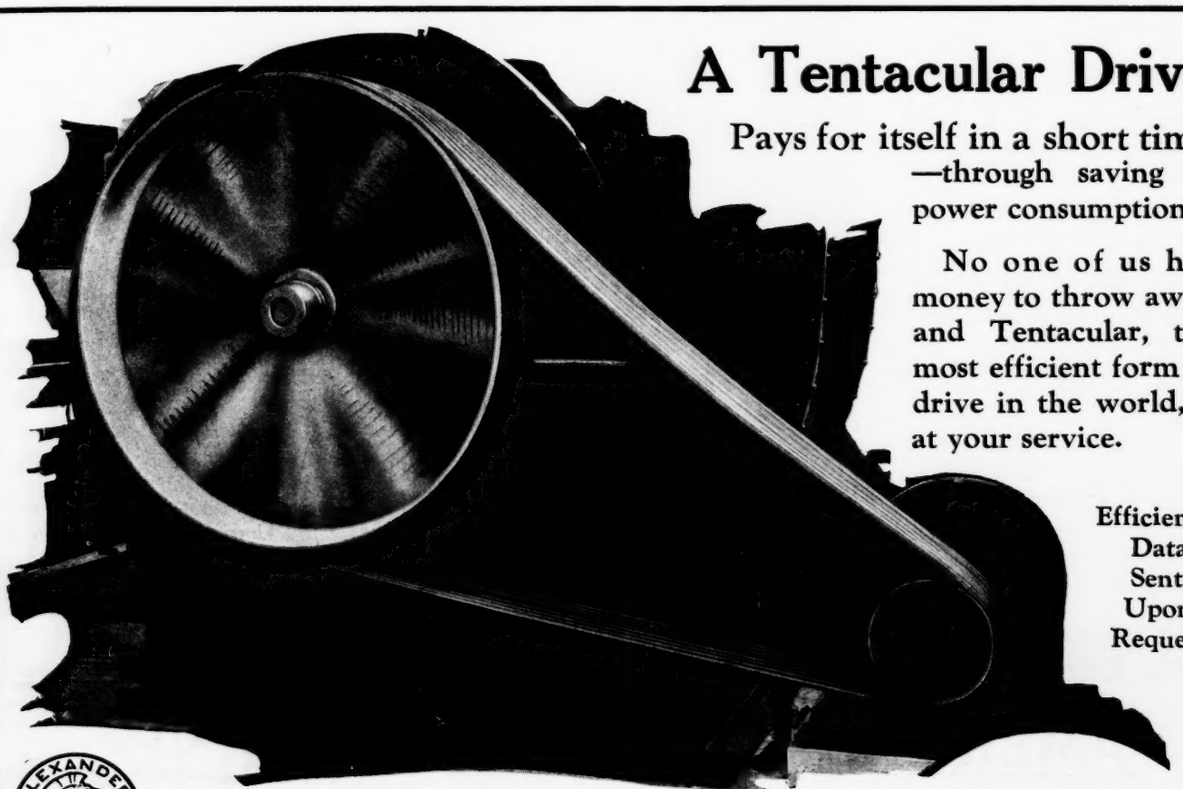
NON-RISING STEM
AND
O. S. and Y. PATTERNS



ALSO MANUFACTURERS OF
Cast and Malleable Iron Fittings
Brass Valves and Fittings

Illinois Malleable Iron Company

1801 Diversey Parkway :-: :-: Chicago, Ill.



A Tentacular Drive

Pays for itself in a short time —through saving in power consumption.

No one of us has money to throw away and Tentacular, the most efficient form of drive in the world, is at your service.

Efficiency Data Sent Upon Request

Typical 50 H.P. Tentacular Fan Drive

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Sole Manufacturers
Branches and Distributors in All Principal Cities.

NORTH STATION INDUSTRIAL BUILDING
Boston

S. Scott Joy, Chicago, Architect
Turner Construction Co., Boston, General Contractor
James S. Cassedy, Cambridge, Heating Contractor

ILLINOIS HEATING SYSTEMS

ILLINOIS
Zone Heat Control

An ILLINOIS two pipe automatic vacuum system, comprising 651 direct radiators and 10 unit-heaters, provides for the heating requirements in this modern 13 story structure. Two 10 inch risers run to the seventh floor; one supplies radiators from the eighth to the thirteenth floors, upfeed, the other from the second to the seventh floors with downfeed. In addition to modulating valves and thermo traps on radiators and drips, 38 blast traps drain the unit-heaters, large risers, and mains.

Five ILLINOIS Zone Control Valves (Hornung Patents), one 6 inch, and four 8 inch, type T, operated by five Mercoid, two circuit thermostats, regulate the temperatures for sections of the building, as follows: The office section from the second to the thirteenth floors, which is in the front end of the building, is controlled by one 6 inch valve. The remainder of the space on these floors is loft space and is controlled by four 8 inch valves. The positive temperature control effected by these valves avoids overheating and results in a marked fuel economy.

Write for the following bulletins

Bulletin 60—
ILLINOIS Zone Control Valves

Bulletin 22—
Vapor Details, ILLINOIS Heating Systems

Boston Representative: **C. W. SISSON, 65 Franklin St.**

REPRESENTATIVES IN 40 CITIES OF U.S.A.

ILLINOIS ENGINEERING COMPANY

ROBT. L. GIFFORD President INCORPORATED 1900

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Heating and Ventilating Data

Subjects Covered

Heat Loss Tables, covering brick, stone, concrete, combinations, tile, frame construction, etc., 8 sheets.

Jones Heat Loss Tables, covering every type of construction (26 authorities), 21 sheets.

Temperature Ranges in U. S., 4 sheets.

Computing Heat Losses, 7 sheets.

Ventilation, 3 sheets.

Air Changes in churches theatres, hospitals, hotels, libraries, schools, etc., 5 sheets.

Measurement of Air Flow, 2 sheets.

Ducts and Flues, including seven sizing methods, 24 sheets.

Duct and Flue Details, including area and weight of ducts, 10 sheets.

Radiation Computing, steam and water, including Groney tables, 40 sheets.
Oil Heating, 3 sheets.

Boilers, horse power and ratios, 2 sheets.

Chimneys, 12 sheets.

Pipe Covering, 6 sheets.

Flow of Steam in Pipes, 13 sheets.

One-Pipe Steam Systems, 10 sheets.

Vacuum Heating Systems, 9 sheets.

Water Heating Systems, gravity, 19 sheets.

Fans, (definitions), 1 sheet.

Belt Drives, 4 sheets.

Exhauster Systems, 2 sheets.

Chemical Laboratories, 1 sheet.

Steam Laundries, 5 sheets.

AN unusual opportunity to own this well known reference work. This splendid collection of tables and data on Radiation, Heat Transmission and Losses, Ventilation, Air Changes, etc., has been used by readers of HEATING AND VENTILATING, ever since it was first featured in the editorial pages of the magazine. In fact many readers have ordered extra binders to take care of the sheets which they clipped from the paper and inserted in their sets.

Data Sheets on Heating and Ventilating

was printed a few years ago to meet the great demand for complete sets of the data sheets that had appeared up to that time. Since it was printed numerous changes have been made, and additional tables have been calculated by engineers. These have been published in the pages of the magazine but have not been included in this set.

On the other hand the editors have carefully gone over the sheets and eliminated those that have been superseded. At the left we have listed the important subjects covered in the revised set of tables now offered. The great value of these tables is attested by the fact that we are continually receiving orders from engineers and dealers for sets of tables on different subjects. These sheets are sold at $.05 each.

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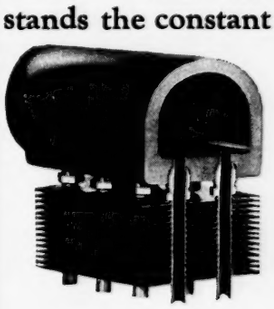

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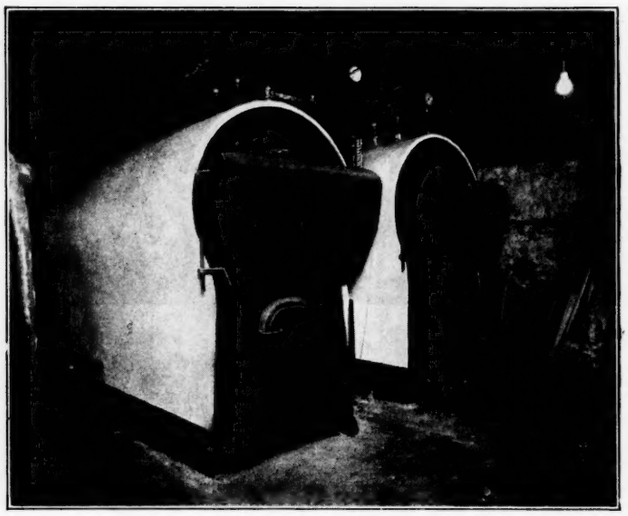

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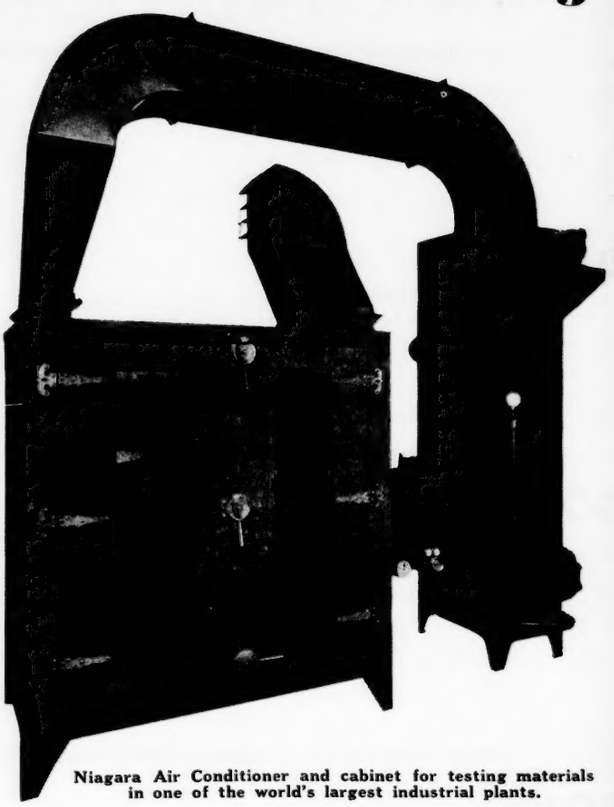

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Heating Division
RACINE WISCONSIN
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Young Unit Heaters

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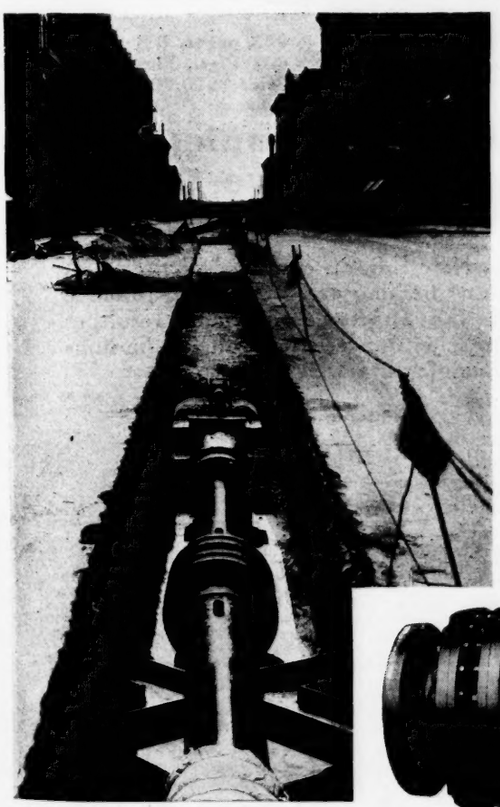

ADSCO Multiple Diaphragm Variator installation on 14"... 250 lb. steam line in one of the large cities in Ohio.

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For the Next Thirty or Forty Years!

THEY have a way ... these Adsco Variators ... of outliving the men who install them. They're put in, covered and forgotten. Expansion is controlled perfectly, no matter how hard the service.

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ADSCO
AMERICAN DISTRICT STEAM COMPANY
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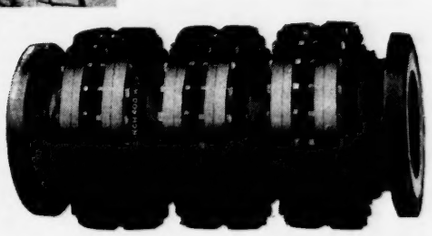
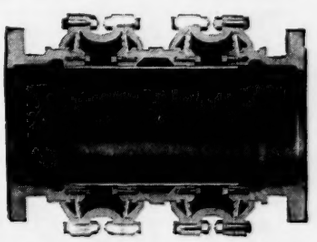
MULTIPLE DIAPHRAGM VARIATOR



Close-up of Multiple Diaphragm Variator. Flexible non-corrosive alloy steel corrugated diaphragms, provide free flexibility. All strain absorbed by body of joint.



Inward and outward limit stops insure each diaphragm taking its proper share of movement. Internal guide cylinder provides free flow of fluid.

OVER FIFTY YEARS IN BUSINESS

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HEAT
IS *Economical*
HEAT

With Sylphon TRADE MARK No. 875

AUTOMATIC RADIATOR VALVES

Room temperature, just as you like it, steady and unchanging, hour by hour, all winter long—that's real winter weather comfort! It prevents sudden colds, —it means better health!

The Sylphon Radiator Valve No. 875 once set at the desired temperature mark is everlastingly carefree and faithful. Its thermostatic element, the dependable Sylphon Bellows, responding to even slight temperature changes in the air, automatically and positively operates the valve, regulates the steam flow to the radiator and maintains just the degree of room warmth desired. It saves in fuel consumption and spells economy in all ways.

SEND FOR BULLETIN No. TH-250

It fully describes the Sylphon Automatic Radiator Valve, (both types, the angle and globe valve) and presents a most interesting story of this compact yet complete controlling device, which Fulton Sylphon engineers have produced after years of research and experiment. In making possible this positive automatic control of steam flow to individual radiators, they have developed the most practical method of temperature control known to modern heating.

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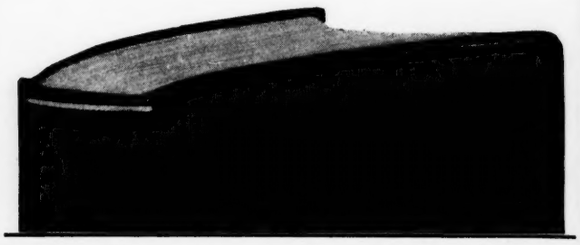

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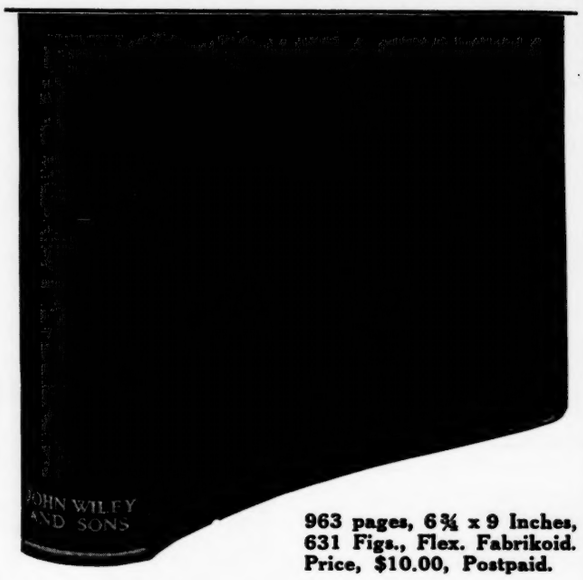

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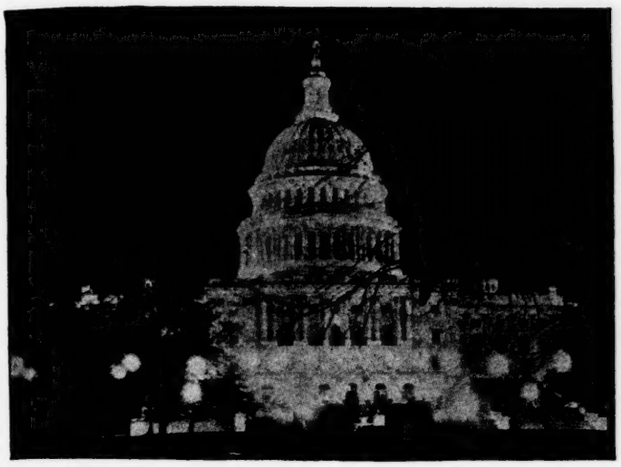

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PANEL AIR FILTER

This filter actually delivers air that is 99 9/10% CLEAN.

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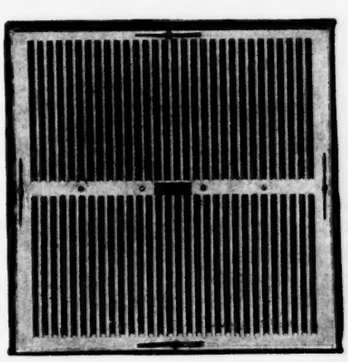
It operates about two months without cleaning and can be cleaned in half a minute per panel with our special vacuum cleaner. Write for interesting catalog.



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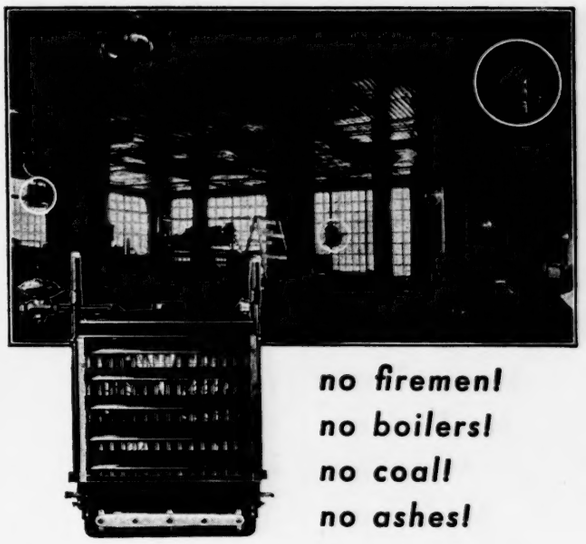

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"Master Control" Valve

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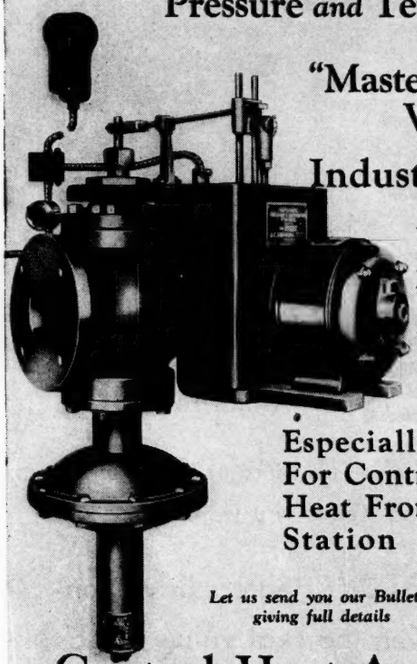
Industrial Type



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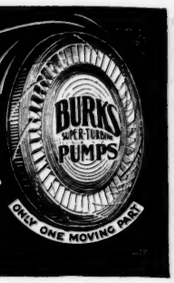

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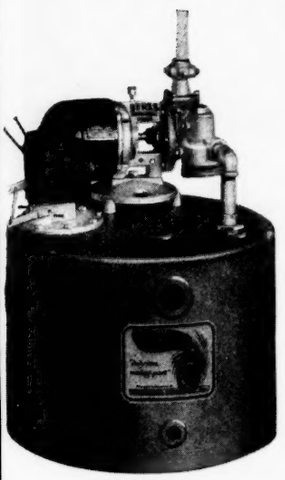

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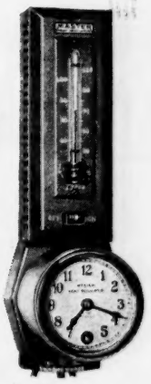

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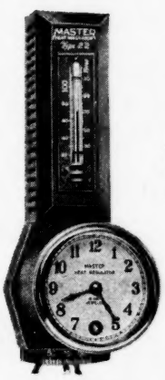

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Type 22

Acts instantly on changes of one degree or less if desired. Full electric motor, 8-Day jewelled clock model, $80. Plain model, same as above, without clock control, $55.

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Tell This to Your Customers!

Install a HYDROLATOR on your hot water heating system. Lower that fuel bill—and *get more heat!*

The HYDROLATOR increases heat in your hot water heating system by forcing water to every radiator in the building many times faster than ordinary thermal circulation—and at far less expense.

Water has greater heat absorption because water temperatures at the boiler are kept lower.

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The HYDROLATOR soon pays for itself in FUEL SAVINGS!

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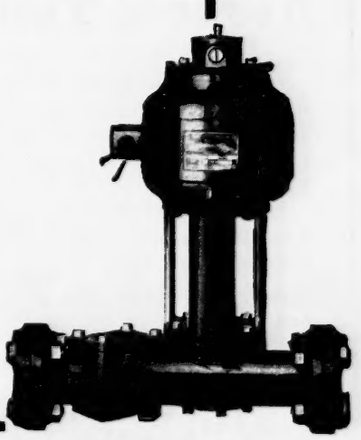

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Any kind of wall radiator can be hung with one of the three styles of E-Z Radiator Hangers. No need for accurate measurement of anchor bolts. Height and lateral variations are easily taken care of by adjustment of the hangers.

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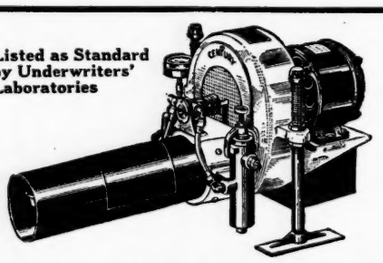

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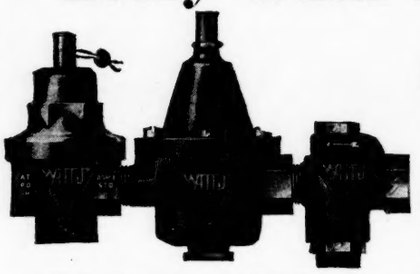

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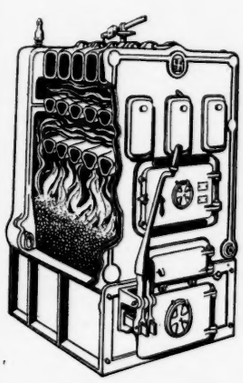

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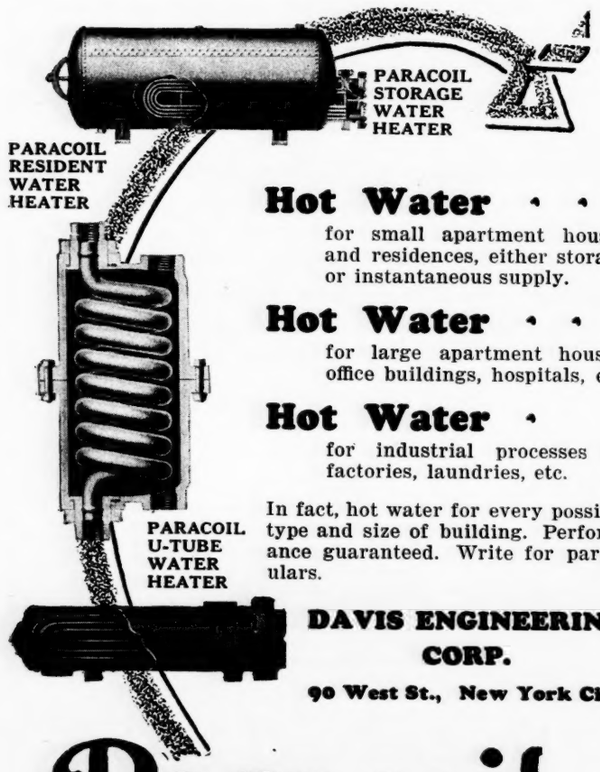

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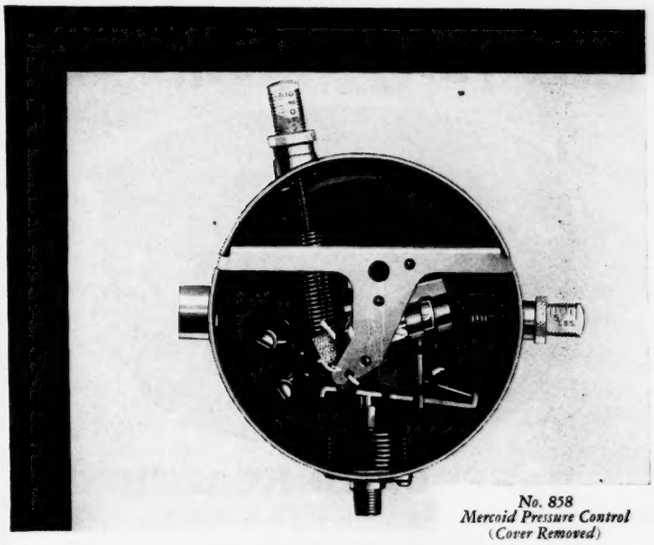

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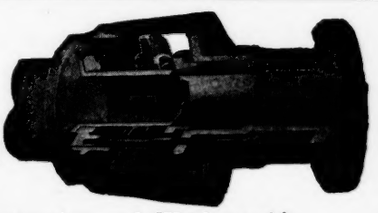

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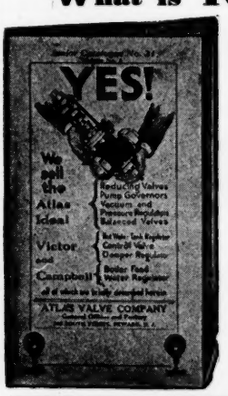

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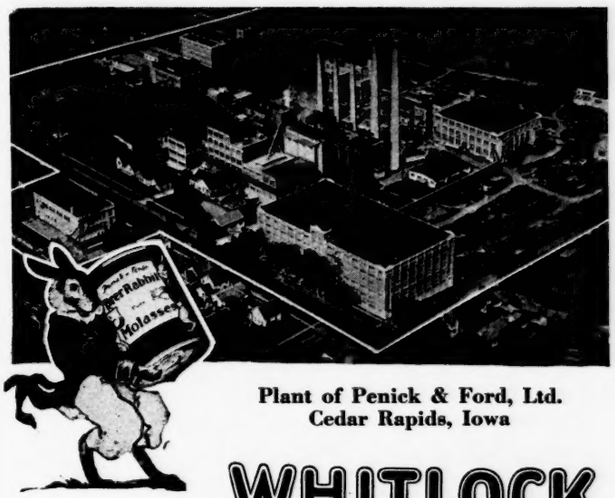

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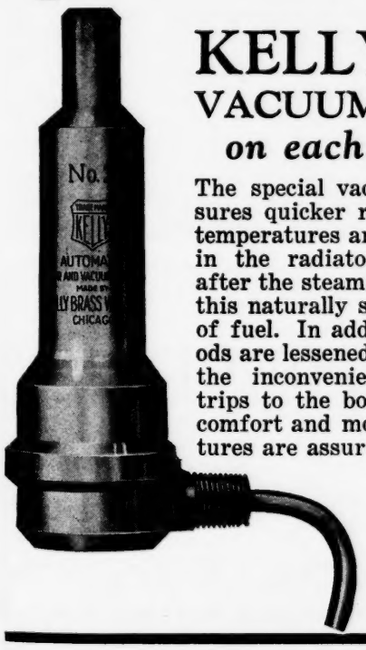

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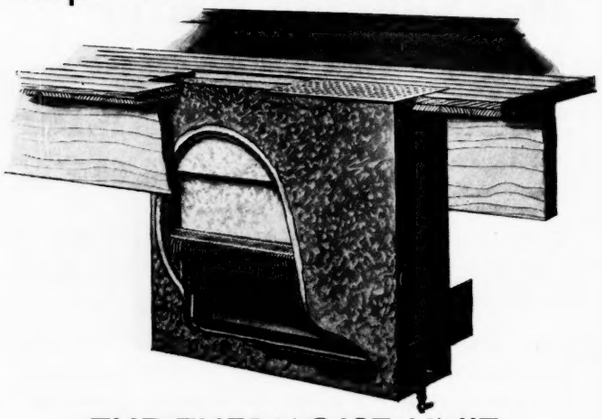

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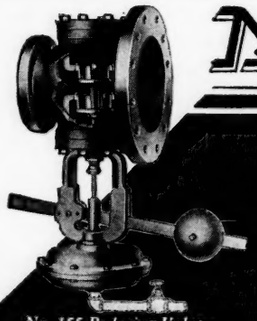

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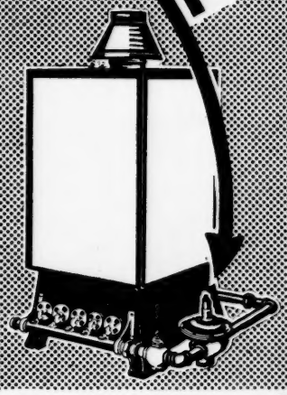

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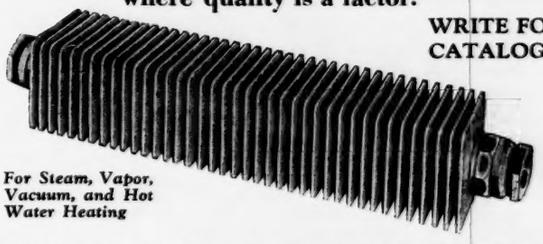

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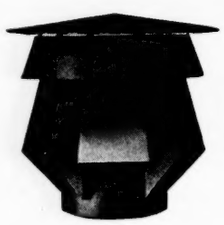

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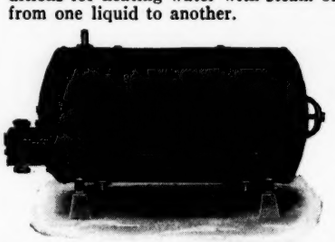

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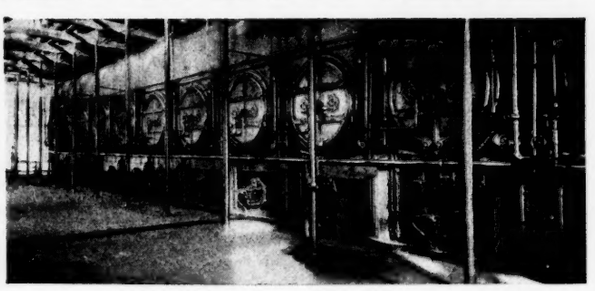

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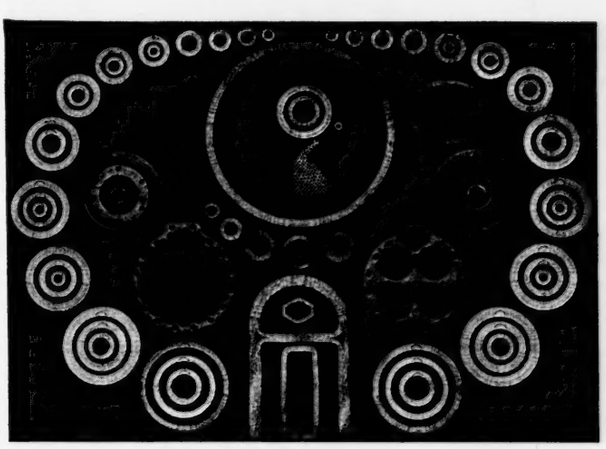

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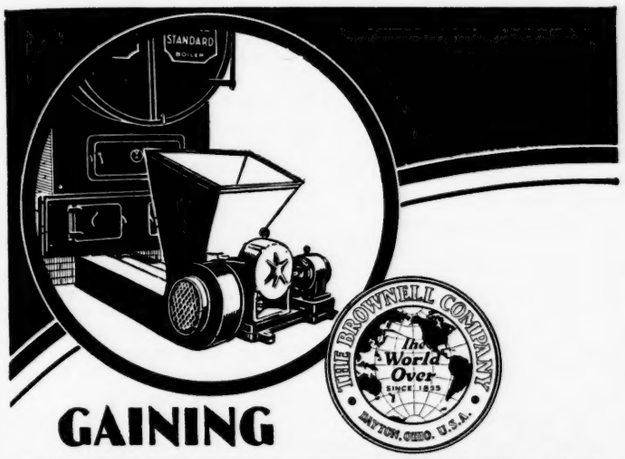

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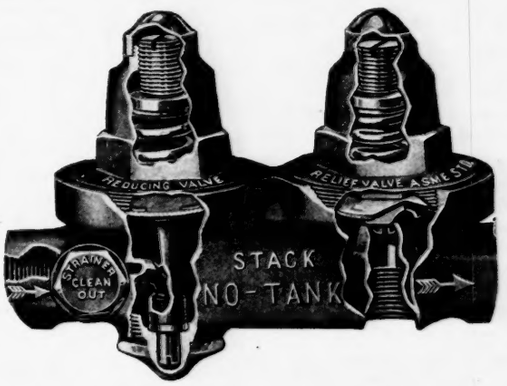

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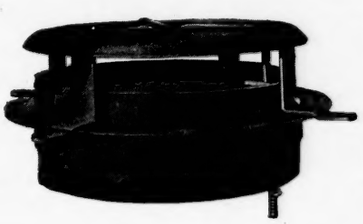

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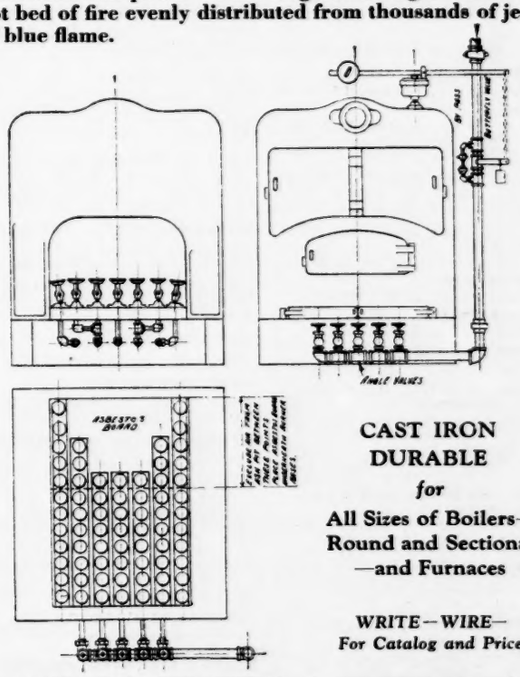

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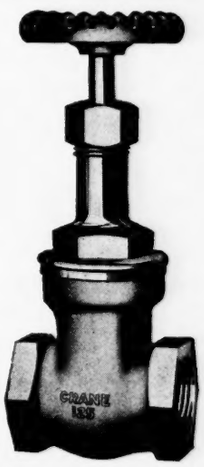
1855 · SEVENTY-FIFTH ANNIVERSARY · 1930

Users' demands built this valve



Crane brass gate valve No. 431

The requirements of users designed this brass gate valve. The quickly worn seating surfaces, the sticking disc . . . two common causes of complaint have been banished by painstaking machining, and accurately fitted guides and ribs.

Leaks have been made practically impossible by the grinding in of the solid wedge disc and by its true fit to the tapered seats.

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So, in every detail, this brass gate valve No. 431 is planned to give unsurpassed service on lines carrying not more than 125 pounds steam working pressures.

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McDermott Water Heaters, Inc., New York, N. Y.
Monitor Boiler Co., Philadelphia, Pa.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
The Stack Heater Co., Boston, Mass.
Weil-McLain Co., Chicago, Ill.
Whitlock Coil Pipe Co., Hartford, Conn.

HEATERS, FEED WATER, (CLOSED)
Alberger Heater Co., Buffalo, N. Y.
Davis Engineering Corp., New York.
Frank Heater & Engineering Co., O. E. Buffalo, N. Y.
Frost Mfg. Co., Galesburg, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Stanwood Corp., Cincinnati, Ohio.
The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.
Whitlock Coil Pipe Co., Hartford, Conn.

HEATERS, FEED WATER (OPEN)
Frost Mfg. Co., Galesburg, Ill.
Stanwood Corp., Cincinnati, Ohio.

HEATERS, FUEL-OIL
Alberger Heater Co., Buffalo, N. Y.
Davis Engineering Corp., New York.
Electrol, Inc., St. Louis, Mo.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
The Stack Heater Co., Boston, Mass.
Gar Wood Engineering Co., Detroit, Mich.
Whitlock Coil Pipe Co., Hartford, Conn.

HEATERS, UNIT
Air-Way Electric Appliance Co., Toledo, Ohio.
Automatic Turbo Heater Co., Chicago, Ill.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
McQuay Radiator Corp., Chicago, Ill.
Nelson Corp., Herman, The, Moline, Ill.
New York Blower Co., Chicago, Ill.
Peerless Unit Ventilation Co., Inc., Bridgeport, Conn.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
U. S. Blower & Heater Corp., Minneapolis, Minn.
Wing Mfg. Co., L. J., New York.
Wolverine Tube Co., Detroit, Mich.
Young Radiator Co., Racine, Wis.

HEATERS, UNIT GAS FIRED
General Gas Light Co., Kalamazoo, Mich.

HEATING SYSTEMS, GAS
Jas. B. Clow & Sons, Chicago, Ill.
Gar Wood Engineering Co., Detroit, Mich.

HEATING SYSTEMS, VACUUM
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., Inc., New York.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

HEATING SYSTEMS, VAPOR
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, O.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Vapor Engineering Co., New York.
Webster & Co., Warren, Camden, N. J.

HEATING SYSTEMS, WATER
American Radiator Co., New York, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Grinnell Co., Providence, R. I.
Hornung, J. C., Chicago, Ill.
Ross Heater & Mfg. Co., Buffalo, N. Y.
The Stack Heater Co., Boston, Mass.

HUMIDIFIERS
American Air Filters Co., Louisville, Ky.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Grinnell Co., Providence, R. I.
Johnson Service Co., Milwaukee, Wis.
Lewis Corp., Minneapolis, Minn.
National Regulator Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
U. S. Blower & Heater Corp., Minneapolis, Minn.
Watts Regulator Co., Lawrence, Mass.
Woodward Co., Frank E., Boston, Mass.

HUMIDITY CONTROL
American Air Filter Co., Louisville, Ky.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Carrier Engineering Corp., Newark, N. J.
Grinnell Co., Providence, R. I.
Johnson Service Co., Milwaukee, Wis.
Lewis Corp., Minneapolis, Minn.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.

INSTRUMENTS, ELECTRIC MEASURING
Bristol Co., The, Waterbury, Conn.

INSTRUMENTS, INDICATING AND RECORDING
Bristol Co., The, Waterbury, Conn.
Marsh & Co., Jas. P. Chicago, Ill.
Mercoid Corporation, Chicago, Ill.

INSULATION, BOILER, PIPE, ETC.
(See Covering, Boiler, Pipe, etc.)

INSULATION, BUILDING
Celotex Co., Chicago, Ill.
Flax-li-num Insulating Co., St. Paul, Minn.
General Insulating & Mfg. Co., Alexandria, Ind.
Insulite Co., Minneapolis, Minn.
Johns-Manville Corp., New York, N. Y.

KETTLES, COPPER
Badger & Sons Co., E. B., Boston, Mass.

MECHANICAL DRAFT APPLIANCES
(See Draft Appliances, Mechanical)

METALS, THERMOSTATIC
Chace Valve Co., W. M., Detroit, Mich.

METERS, CONDENSATION
Central Station Steam Co., Detroit, Mich.

METERS, FEED WATER
Central Station Steam Co., Detroit, Mich.

METERS, PITOT TUBE
Buffalo Forge Co., Buffalo, N. Y.

METERS, WATER, GAS, OIL & AIR
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

MOTORS (ELECTRIC)
Baldor Electric Co., St. Louis, Mo.
Century Electric Co., St. Louis, Mo.
Emerson Electric Mfg. Co., St. Louis, Mo.
Janette Mfg. Co., Chicago, Ill.
Ohio Electric Mfg. Co., Cleveland, O.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

NOZZLES, SPRAY
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

OIL BURNERS
Century Engineering Co., Cedar Rapids, Ia.
Electrol Inc., St. Louis, Mo.
Johnson Co., S. T., Oakland, Cal.
Petroleum Heat & Power Co., New York
Silent Automatic Corp., Detroit, Mich.

OIL BURNER EQUIPMENT
Buffalo Forge Co., Buffalo, N. Y.
Cook Electric Co., Chicago, Ill.
Hornung, J. C., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
Johnston Bros., Inc., Ferrysburg, Mich.
Schutte & Koerting Co., Philadelphia, Pa.

OIL BURNER IGNITION AND CONTROL EQUIPMENT
McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Penn Electric Switch Co., Des Moines, Iowa.
Penn Heat Control Co., Philadelphia, Pa.
Time-O-Stat Controls Co., Elkhart, Ind.
White Mfg. Co., St. Paul, Minn.

OZONE APPARATUS
United States Ozone Co. of America, Scottdale, Pa.

PIPE BENDING
Badger & Sons Co., E. B., Boston, Mass.
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Whitlock Coil Pipe Co., Hartford, Conn.

PIPE, CAST-IRON
American Radiator Co., New York.

PIPE HANGERS
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.

PIPE THREADING & CUTTING MACHINES
Crane Co., Chicago, Ill.

PIPE, STEEL
Crane Co., Chicago, Ill.
National Tube Co., Pittsburgh, Pa.

PRESSURE REDUCING VALVES
(See Regulators, Pressure).

PUMPS, CENTRIFUGAL
American Steam Pump Co., Battle Creek, Mich.
Nash Engineering Co., So. Norwalk, Ct.

PUMPS, CENTRIFUGAL, VACUUM HEATING
American Steam Pump Co., Battle Creek, Mich.
Ames Pump Co., New York.
Hoffman Specialty Co., New York.
Nash Engineering Co., So. Norwalk, Ct.
Skidmore Corp., Chicago, Ill.

PUMPS, CONDENSATION
American Steam Pump Co., Battle Creek, Mich.
Ames Pump Co., New York.
Decatur Pump Co., Decatur, Ill.
Hoffman Specialty Co., New York.
Nash Engineering Co., So. Norwalk, Ct.
Skidmore Corp., Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.

PUMPS, OIL
Janette Mfg. Co., Chicago, Ill.

PUMPS, SUMP
American Steam Pump Co., Battle Creek, Mich.
Janette Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Ct.

PUMPS, TURBINE
Ames Pump Co., New York.
Decatur Pump Co., Decatur, Ill.
Nash Engineering Co., So. Norwalk, Ct.

PUMPS, VACUUM
American Steam Pump Co., Battle Creek, Mich.
Ames Pump Co., New York.
Janette Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Ct.
Skidmore Corp., Chicago, Ill.

RADIATION, LIGHT WEIGHT, NON FERROUS
American Radiator Co., New York.
McQuay Radiator Co., Chicago, Ill.
The Herman Nelson Corp., Moline, Ill.
Winchester Repeating Arms Co., New Haven, Conn.
Young Radiator Co., Racine, Wis.

RADIATOR ENCLOSURES AND SHIELDS
McQuay Radiator Corp., Chicago, Ill.

RADIATOR HANGERS
American Radiator Co., New York, N. Y.
Grinnell Co., Providence, R. I.
Hartmann Co., Charles, Brooklyn, N. Y.
Healy-Ruff Co., St. Paul, Minn.
Kewanee Boiler Corp., Kewanee, Ill.
McAlear Mfg. Co., Chicago, Ill.

RADIATOR TUBES, COPPER
Wolverine Tube Co., Detroit, Mich.

RADIATORS, CABINET AND CONCEALED
Air-Way Electric Appliance Co., Toledo, Ohio.
Fintube Radiator Co., Long Island City, N. Y.
McQuay Radiator Corp., Chicago, Ill.
Nelson Corp., Herman, The, Moline, Ill.
Young Radiator Co., Racine, Wis.

RADIATORS, CAST-IRON
American Radiator Co., New York, N. Y.
Burnham Boiler Corp., Irvington, N. Y.
Crane Co., Chicago, Ill.
Kewanee Boiler Corp., Kewanee, Ill.
Nelson Corp., Herman, The, Moline, Ill.

RADIATORS, GAS-FIRED
American Radiator Co., New York, N. Y.
Jas. B. Clow & Sons, Chicago, Ill.

RADIATORS, VERTICAL FIN
Wolverine Tube Co., Detroit, Mich.

RECEIVERS, AIR
Brownell Co., The, Dayton, Ohio.
Frost Mfg. Co., Galesburg, Ill.
Vapor Engineering Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

RECEIVERS, CONDENSATION
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
The Stack Heater Co., Boston, Mass.
Vapor Engineering Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

REGULATORS, BOILER-FEED
Atlas Valve Co., Newark, N. J.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.

REGULATORS, DAMPER
American Radiator Co., New York, N. Y.
Atlas Valve Co., Newark, N. J.
Barber-Colman Co., Rockford, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
The Stack Heater Co., Boston, Mass.
Sterling Engineering Co., Milwaukee, Wis.
Watts Regulator Co., Lawrence, Mass.
White Mfg. Co., St. Paul, Minn.

REGULATORS, GAS
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

REGULATORS, PRESSURE
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.

FIGURE 106-A *with the one-piece screw-over bonnet and slip-on stay-on disc holder . . .*

THIS is the Standard Bronze Globe Valve that engineers are talking about. It is the Jenkins with the one-piece screw-over bonnet, and the slip-on stay-on disc holder.

The screw-over bonnet contributes great strength. Take the bonnet off and put it back repeatedly. It won't spring or distort . . . because it is made from a single piece of selected Jenkins bronze.

The slip-on stay-on disc holder is another advantage. Give the hand wheel of the valve a turn or so and the bonnet can be removed without danger of the disc holder falling off. Then give the wheel a reverse turn, and off drops the disc holder into your hand.

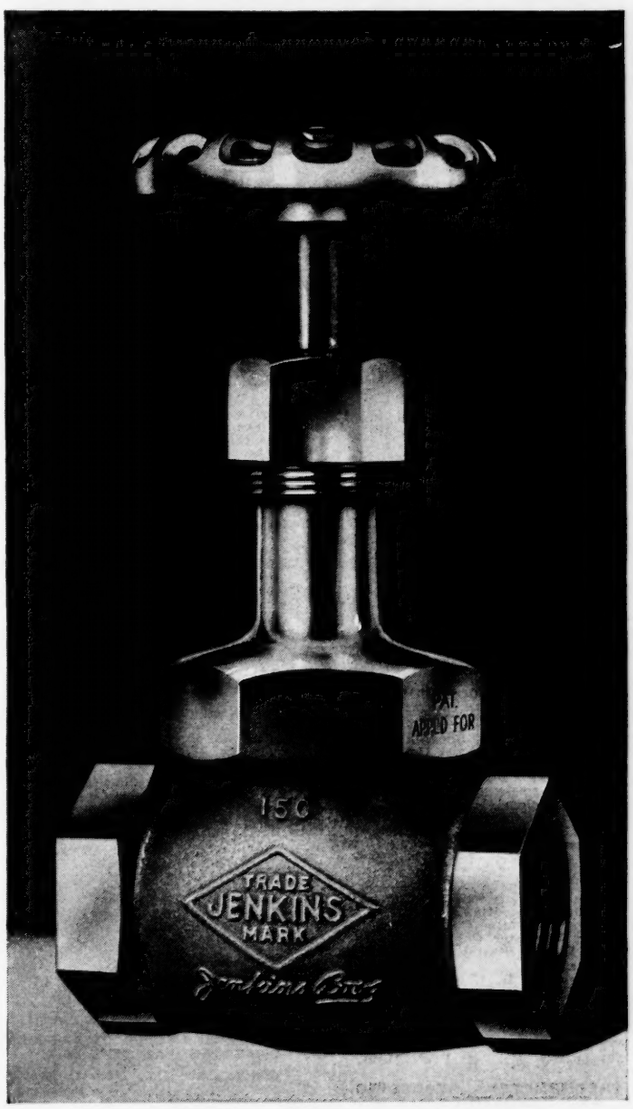
Your supply man can furnish these valves in globe, angle, cross and check, screwed or flanged. Write for Bulletin 141.

JENKINS BROS.

80 White Street, New York, N. Y. 524 Atlantic Avenue, Boston, Mass. 133 No. Seventh Street, Philadelphia, Pa.
646 Wash. Blvd., Chicago, Ill. 1121 No. San Jacinto, Houston, Tex.
JENKINS BROS., Limited, Montreal, Canada; London, England
Factories: Bridgeport, Conn.; Elizabeth, N. J.; Montreal, Canada

Jenkins
VALVES
Since 1864

FIG. 106-A, *Screwed, Jenkins Standard Bronze Globe Valve, with one-piece screw-over bonnet, and slip-on stay-on disc holder. For 150 lbs. steam working pressure, or 250 lbs. oil, water, gas working pressure.*



JENKINS VALVES ARE ALWAYS MARKED WITH THE "DIAMOND"

Johnson Service Co., Milwaukee, Wis.
Kainer & Company, Chicago, Ill.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.

REGULATORS, TEMPERATURE
(See Temperature Control)

REGULATOR, WATER
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

SEPARATORS, OIL
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Webster & Co., Warren, Camden, N. J.

SEPARATORS, STEAM
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Webster & Co., Warren, Camden, N. J.

SPRAY COOLING SYSTEMS
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

SPRAY NOZZLES
(See Nozzles, Spray)

STERILIZER, WATER
U. S. Ozone Corp., Scottdale, Penn.

STOKERS, MECHANICAL
Brownell Co., Dayton, Ohio.
Detroit Stoker Co., Detroit, Mich.
Domestic Stoker Co., New York.
Whiting Corp., Harvey, Ill.

STRAINERS, OIL
Bishop & Babcock Sales Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.

STRAINERS, STEAM
Bishop & Babcock Sales Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.

STRAINERS, WATER
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.

TANKS, COPPER
Badger & Sons Co., E. B., Boston, Mass.

TEMPERATURE CONTROL
American Radiator Co., New York, N. Y.
Atlas Valve Co., Newark, N. J.
Barber-Colman Co., Rockford, Ill.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Carrier Engineering Corp., Newark, N. J.
Fulton Sylphon Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
Kieley & Mueller, Inc., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Penn Electric Switch Co., Des Moines, Iowa.
Raymond, F. I., Chicago, Ill.
Sarco Co., Inc., New York.
The Stack Heater Co., Boston, Mass.
Sterling Engineering Co., Milwaukee, Wis.
Time-O-Stat Controls Co., Elkhart, Ind.
Watts Regulator Co., Lawrence, Mass.
White Mfg. Co., St. Paul, Minn.

THERMOMETERS, RECORDING AND INDICATING
American Radiator Co., New York, N. Y.
Bristol Co., The, Waterbury, Conn.
Marsh & Co., Jas. P., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.

THERMOSTATIC METAL
W. M. Chace Valve Co., Detroit, Mich.

THERMOSTATS
Barber-Colman Co., Rockford, Ill.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Johnson Service Co., Milwaukee, Wis.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Time-O-Stat Controls Co., Elkhart, Ind.
White Mfg. Co., St. Paul, Minn.

TRAPS, BUCKET
Crane Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.

TRAPS, FLOAT
Crane Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., Inc., New York.

TRAPS, FLOAT & THERMOSTATIC
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., Inc., New York, N. Y.

TRAPS, INVERTED BUCKET (STEAM AND AIR)
Armstrong Machine Wks., Three Rivers, Mich.

TRAPS, LIFTING
Crane Co., Chicago, Ill.
Lytton Mfg. Corp., Franklin, Va.

TRAPS, RADIATOR
Armstrong Machine Wks., Three Rivers, Mich.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johns-Manville Corp., New York, N. Y.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Sterling Engineering Co., Milwaukee, Wis.
Vapor Engineering Co., New York City.
Webster & Co., Warren, Camden, N. J.

TRAPS, RETURN
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville Corp., New York, N. Y.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

TRAPS, STEAM
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Davis Engineering Corp., New York.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville Corp., New York, N. Y.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.

TRAPS, VACUUM
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

TUBING, COPPER AND BRASS
Crane Co., Chicago, Ill.

TUBING, SEAMLESS, COPPER, BRASS AND ALUMINUM
Wolverine Tube Co., Detroit, Mich.

TURBINES, STEAM
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

TURBO-BLOWERS
Bayley Blower Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

UNIT HEATERS
(See Heaters, Unit)

VACUUM CLEANING APPARATUS
American Radiator Co., New York, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

VALVES, ACID RESISTING
Crane Co., Chicago, Ill.

VALVES, AIR, AUTOMATIC
American Radiator Co., New York, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Fulton Sylphon Co., Knoxville, Tenn.
Hoffman Specialty Co., New York.
Jenkins Bros., New York.
Kelly Brass Works, Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.

VALVES, AIR RELIEF
American Radiator Co., New York, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Sarco Co., Inc., New York.
The Stack Heater Co., Boston, Mass.

VALVES, BACK PRESSURE
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Schutte & Koerting Co., Philadelphia, Pa.

VALVES, BALANCED
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.

VALVES, BLOW-OFF
Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Lytton Mfg. Corp., Franklin, Va.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

VALVES, CHECK
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Schutte & Koerting Co., Philadelphia, Pa.

VALVES, DIFFERENTIAL RELIEF, GAS
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

VALVES, FLOAT
Atlas Valve Co., Newark, N. J.
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Time-O-Stat Controls Co., Elkhart, Ind.
Watts Regulator Co., Lawrence, Mass.

VALVES, GATE
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh Valve Co., Dunkirk, N. Y.

VALVES, GLOBE, ANGLE & CROSS
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh Valve Co., Dunkirk, N. Y.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.

VALVES, HYDRAULIC-OPERATING
Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.

VALVES, MAGNETIC
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Time-O-Stat Controls Co., Elkhart, Ind.

VALVES, NON BY-PASS
The Stack Heater Co., Boston, Mass.

VALVES, NON-RETURN
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.

VALVES, RADIATOR
American Radiator Co., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Marsh Valve Co., Dunkirk, N. Y.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Vapor Engineering Co., New York.
Webster & Co., Warren, Camden, N. J.

VALVES, PRESSURE REDUCING
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VALVES, REGULATING
Atlas Valve Co., Newark, N. J.
Barber-Colman Co., Rockford, Ill.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Fulton Sylphon Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kainer & Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.

VALVES, RELIEF (WATER)
Crane Co., Chicago, Ill.
Kainer & Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
The Stack Heater Co., Boston, Mass.

VALVES, SAFETY
American Radiator Co., New York, N. Y.
Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
The Stack Heater Co., Boston, Mass.
Time-O-Stat Controls Co., Elkhart, Ind.

VALVES, STOP AND CHECK
(See Valves, Non-Return)

VALVES, VACUUM RELIEF
The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.

VENTILATING SYSTEMS
American Blower Co., Detroit, Mich.
American Radiator Co., New York, N. Y.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
National Regulator Co., Chicago, Ill.
Nelson Corp., Herman, The, Moline, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
U. S Blower & Heater Corp., Minneapolis, Minn.
Wing Mfg. Co., L. J., New York.

VENTILATORS
Bayley Blower Co., Milwaukee, Wis.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

VENTILATORS, FLOOR
Aeolus Dickinson, Chicago, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Knowles Mushroom Ventilator Co., New York.
Ventilating Products Co., Chicago, Ill.

VENTILATORS, ROOF
Aeolus Dickinson, Chicago, Ill.

VENTILATORS, UNIT
Nelson Corp., Herman, The, Moline, Ill.
Peerless Unit Ventilation Co., Inc., Bridgeport, Conn.
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America's Standard Wrought Pipe

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US STEEL

SCALE FREE PIPE
SPELLERIZED

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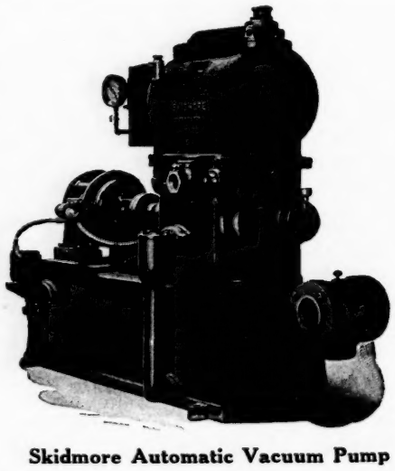
Skidmore Vacuum Pump Design

Assures Maintained Efficiency



Skidmore Automatic Vacuum Pump

The design of the SKIDMORE VACUUM PUMP minimizes wear. With wear greatly eliminated, the unit is necessarily long lived and its efficiency will be maintained. To accomplish this the Skidmore Vacuum Pump was constructed in such a way as to necessitate "no close clearances between moving parts." By doing this, the small particles of scale and core sand from the system which pass the strainer find no place to wedge themselves and wear the internal parts of the unit, destroying its efficiency. With this type of design the unit will run for years with no noticeable drop in its air and water handling capacities.

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OFFICE AND FACTORY—1535 DAYTON STREET

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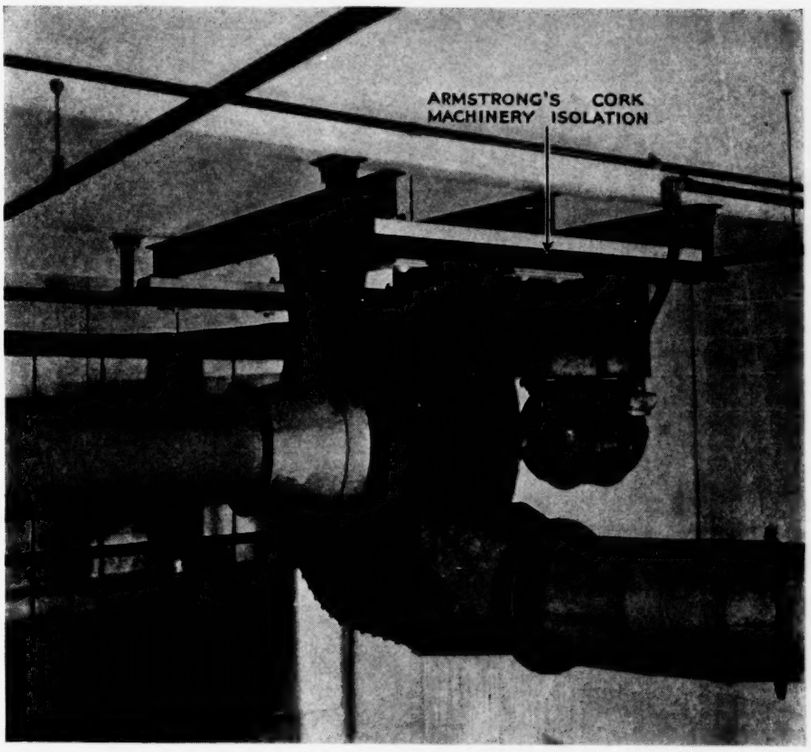
SKIDMORE PUMPS ARE MADE AND SOLD IN CANADA BY DARLING BROS., LTD., MONTREAL

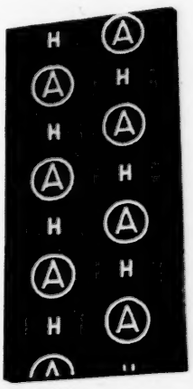
At the ceiling or on the floor....

MACHINES *that vibrate can be* MUFFLED *with* CORK



At the ceiling, Armstrong's Cork Machinery Isolation protects this dust conductor against vibration and noise.

MOVING machinery will vibrate. But the bad effects of that vibration can be muffled immediately with cork. Thereby costly damages are avoided—to the machine itself, to nearby machines, gauges, and precision instruments, and to the building structure. Quieting of machines also contributes to the comfort and efficiency of employees.



Marked for your convenience, Circle A means Armstrong; "H" stands for "heavy," one of the three densities.

In the case of the dust conductor, shown on this page, vibration and noise were checked at the source with the installation of Armstrong's Cork Machinery Isolation. The cork absorbs all vibration. You see, it makes no difference where the machine is located—up at the ceiling or on the floor.

Since Armstrong's Cork Machinery Isolation is made in three densities and seven thicknesses, practically any type of moving machine can be quieted. And this is important not only in factories, but in office buildings, apartment houses, and similar buildings.

Perhaps this sounds expensive to you. It isn't. For a few dollars—the cost is very reasonable—you remove permanently a serious drawback to efficient operation. Since cork takes no "set" even under sustained compression, it keeps its resiliency after years of service.

Armstrong engineers will gladly recommend the proper thickness and density for your particular needs. And we suggest that you look around your plant for other uses for Armstrong's Cork Machinery Isolation. Engineers and architects already have discovered its value for building construction and elevated highways. Full information can be secured on request. Armstrong Cork & Insulation Co., 925 Concord Street, Lancaster, Pa.

Armstrong's (A) Product

Muffle These Machines

What items interest you? Armstrong's Cork Machinery Isolation can be used for: air compressors, blowers, drill presses, drop hammers, elevator hoists, engines, fans, forging machines, machine tools, motors, motor generators, printing presses, pumps, punching machines, refrigerating machines, vacuum cleaners, and similar apparatus.

Armstrong's Cork Machinery Isolation

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WITHIN recent months Jas. P. Marsh & Company has presented to the trade a series of heating units and specialties of advanced design . . . the utmost in *truly modern heating*. Now we offer the new Marsh Heating Catalog completely describing these products. We are confident that it will receive the same enthusiastic reception that was accorded to the modern heating products.

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Please send me the new edition of your heating catalog. I would like to talk to your representative about

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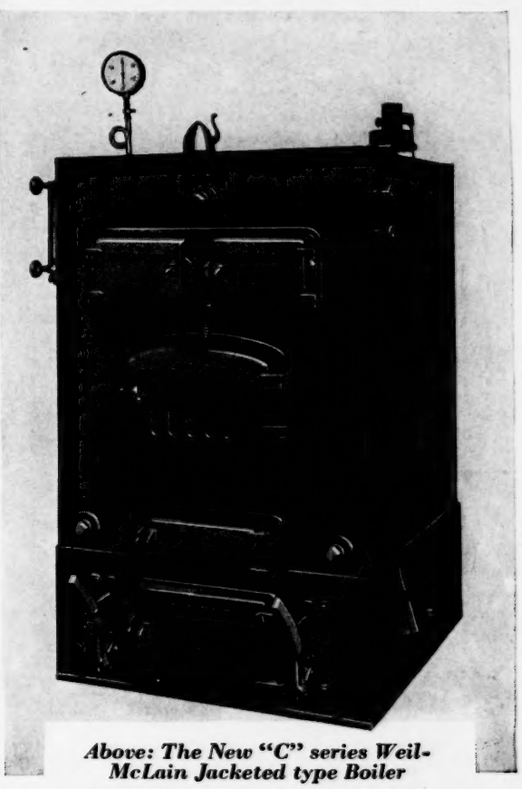
A *New* Weil-McLain Boiler *for new business*

Weil-McLain Jacketed Boilers for modern basements and modern fuels *appeal to both new and remodeling markets!* It is easy to show home owners with out-of-date heating plants how much these *modern* boilers will save them—in fuel costs—in comfort—and in health



Above: The New "C" series Weil-McLain Jacketed type Boiler

THE new "C" series Weil-McLain Jacketed Boiler has a larger capacity. In all other ways it has the same advantages and features that are found in the "A" series Jacketed Boiler. Its beautiful appearance makes it most desirable for installation in modern basements. Its remarkable heat-absorbing features, combined with quick internal circulation, makes it an excellent boiler for oil burning. Both the "A" and the new "C" series Weil-McLain Jacketed Boilers have the following well-known Weil-McLain features that enable them to *fight fuel waste and deliver more heat*—regardless of the type of fuel burned.

Scientific combustion, made possible by the design of Weil-McLain Jacketed Boilers, fights high fuel bills by providing more thorough final burning of the fuel—first, because all grates within the fire box are *shaking* grates, and second, because rounded "live fire" corners in the fire box assure a clean, bright fire at every point.

More heat-absorbing surface, resulting from the extra wide crown sheet and its corrugated effect, increases the heat-absorbing ability of the boiler and sends more heat to the radiators.

Balanced back-and-forth fire travel, which prevents short-cutting to the chimney, forces hot gases from the fire to travel through *all* the heating surfaces in the boiler, fighting fuel waste up the chimney.

Convenient operation is assured by such features as a choke damper controlled from the *front* of the boiler—automatic draft regulation—and a fuel-carrying capacity that makes possible a minimum of firing attention.

In the complete line of Weil-McLain Boilers you will find equivalent scientific principles of design that enable these boilers to *fight fuel waste and deliver more heat.* The line includes Round Type, Jacketed, Square, Self-Feed and Smokeless Boilers. Also Weil-McLain "Cameo" Radiators.

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Weil-McLain
SCIENTIFIC COMBUSTION
BOILERS

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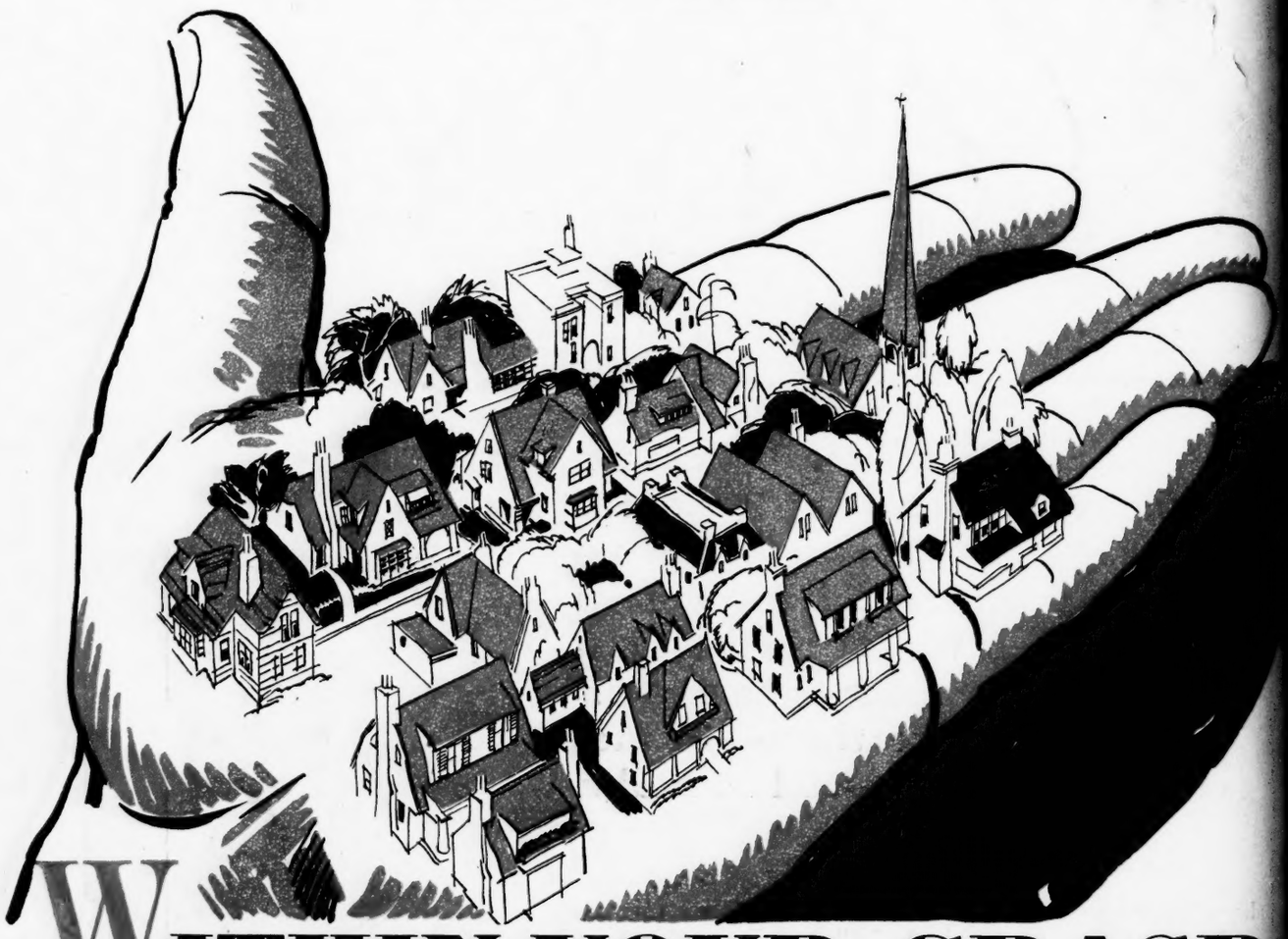
FIGHT FUEL WASTE AND DELIVER MORE HEAT



WITHIN YOUR GRASP

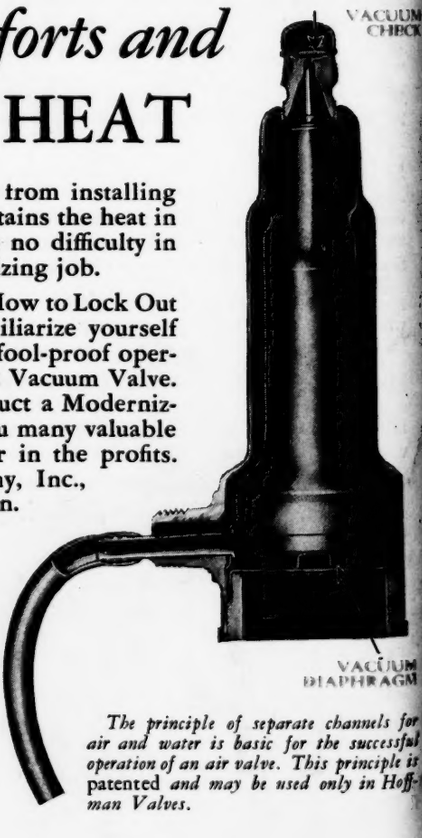
are many homes eager for the comforts and economy of HOFFMAN-IZED HEAT

Every owner of a one-pipe steam job in your vicinity, is a live prospect for a Hoffman-ized Vacuum System. They are being forcefully reminded by our National Advertising of the extra comfort hours and great fuel savings available from the installation of Hoffman No. 2 Vacuum Valves.

Only one step is necessary to move them to action, and that step is yours. Call on them! Install a sample valve—explain how Hoffman-ized radiators heat quicker and hold heat longer—tell them of the fuel saving—and give them an estimate right then and there.

After observing the results from installing one valve—seeing how it retains the heat in the radiator—you will have no difficulty in landing a complete modernizing job.

Send now for our booklet "How to Lock Out Air, the Heat Thief." Familiarize yourself with the sure, efficient, and fool-proof operation of the Hoffman No. 2 Vacuum Valve. Our booklet "How to Conduct a Modernizing Campaign" will give you many valuable pointers on how to gather in the profits. Hoffman Specialty Company, Inc., Dept. C-68, Waterbury, Conn.



The principle of separate channels for air and water is basic for the successful operation of an air valve. This principle is patented *and may be used only in Hoffman Valves.*

HOFFMAN
No. 2 Vacuum Valves
for one-pipe steam systems